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OCEAN WASTE DISPOSAL PRACTICES IN METROPOLITAN AREAS

Charles F. McFarlane

Interstate Electronics Corporation

Prepared for:

Environmental Protection Agency

February 1974

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OCEAN WASTE DISPOSAL PRACTICES in METROPOLITAN AREAS of CALIFORNIA

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This report presents the results of a fact-finding survey of ocean waste disposal practices in the Southern California and San Francisco Metropolitan areas of California. It is a portion of an extensive study on ocean waste disposal practices in selected areas of the United States.

Information was collected by field interviews and survey techniques and supplemented by literature and data studies. The sum of the information was used to establish a data base for the development of guidelines and criteria for the control of ocean waste disposal.

A short bibliography of selected current references is provided.

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FEBRUARY 1974

OCEAN WASTE DISPOSAL PRACTICES IN METROPOLITAN AREAS OF CALIFORNIA

By

Charles F. McFarlane

Prepared for the

U.S. ENVIRONMENTAL PROTECTION AGENCY
OCEAN DISPOSAL PROGRAM
Under Contract 68-01-0736

Prepared by

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This report was written by Mr. Charles F. McFarlane as a part of a comprehensive study of ocean waste disposal in selected geographic areas.

The readers comments and suggestions are solicited and should be addressed to Mr. Sam Kelly, Project Manager.

R. Timme

R.C. Timme
Division Manager

l.i.

Section 1

OCEAN WASTE DISPOSAL PRACTICES IN METROPOLITAN AREAS OF CALIFORNIA

1.1 INTRODUCTION

The Environmental Engineering Division of Interstate Electronics Corporation was engaged by the Environmental Protection Agency, Ocean Disposal Program under Contract No. 68-01-0796 to investigate the past and present ocean disposal practices in the United States. The information was desired to support the development of guidelines and criteria for the control of ocean disposal in accordance with Public Law 92-532, "Marine Protection Research and Sanctuaries Act of 1972".

Six areas were intensively studied by field surveys and literature searches: New York Bight; Charleston,SC; segments of the Gulf coast; Southern California; San Francisco and Pudget Sound. These areas represented a cross-section of ocean dumping practices in the United States.

The findings of this study were presented in Report No. 4460C1541, "Ocean Waste Disposal in Selected Geographic Areas".

The following information covers the Southern California and San Francisco areas and was obtained by an extensive literature search and by personal interviews of personnel concerned with management of ocean waste disposal.

SUMMARY

Ocean waste disposal in the Los Angeles and San Francisco areas has been on a decline for several years. Except for the garbage and trash site in Los Angeles and the San Francisco Bar dredge spoil site the disposal sites are now inactive. The primary reason for this decline can be related to the efforts of regulatory agencies to protect the environment from uncontrolled disposal programs. Some ocean dumping was stopped by direct action by the regulatory agencies, while others have ceased to operate because the cost of providing information on the effects of a disposal operation has made alternate methods of disposal more attractive.

The two active sites are the dredge spoil site for the maintenance of the San Francisco Bar (Main Ship Channel) and the garbage and trash site southeast of Catalina Island near Los Angeles. It is anticipated that the dredge spoil site will remain active indefinitely and that the garbage and trash site will probably be phased out as the cost of proposed monitoring programs will make alternate disposal methods more attractive.

Prior to the enactment of PL 92-532, the management of waste disposal in both areas was not well organized. Because of the lack of available personnel to review and check on the validity of dumper reports and their operations, data that should indicate materials, volumes and concentrations of the liquid components was at best very vague. This did not allow a complete analysis of the possible effects of materials on the dump site biota.

The disposal areas have not been studied extensively by the academic organizations. The information collected was not in a form that could be readily useable and more more detailed information is required to evaluate the inactive and presently used disposal sites.

Section 2

OCEAN WASTE DISPOSAL PRACTICES IN SOUTHERN CALIFORNIA

2.1 INTRODUCTION

The ocean waters of Southern California that have been impacted by ocean dumping from the Los Angeles and San Diego metropolitan areas are the subject of this section. Two sites are presently used for ocean disposal. Figure 2-1 is a portion of National Ocean Survey Chart No. 5020 showing locations of existing and past dump sites in the study area.

A discussion of past ocean dumping practices is presented in Section 2.2, along with present activities, including site descriptions and oceanographic, biological, and meteorologic summaries for the study area. Materials presently being disposed of in the study area are trash and garbage from vessels, and industrial wastes. Present activities are analyzed in Section 2.5, and recommendations are presented for the future use of individual sites.

SOUTHERN CALIFORNIA

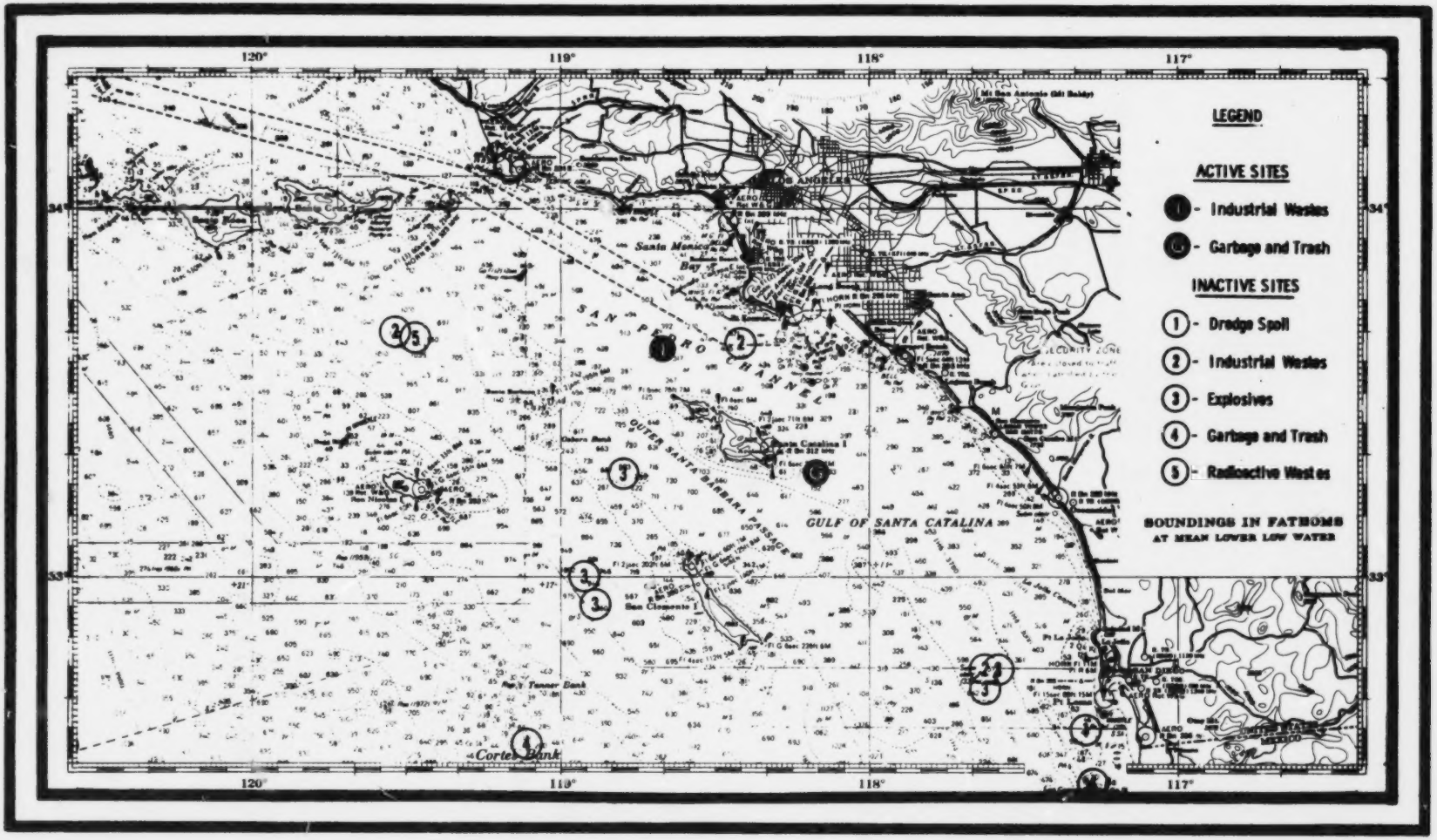


FIGURE 2-1

LOCATIONS OF PAST AND EXISTING OCEAN DUMPING SITES SOUTHERN CALIFORNIA

INTERSTATE ELECTRONICS CORPORATION

2.2 HISTORY OF DUMPING IN THE SOUTHERN CALIFORNIA AREA

Materials in eight categories have been disposed of in the ocean areas of Southern California: (1) industrial wastes, (2) refinery wastes, (3) trash and garbage, (4) filter cake, (5) oil drilling wastes, (6) explosives, (7) radioactive wastes, and (8) miscellaneous wastes. Estimates of the amounts of waste disposed of between 1931 and 1973 are summarized by category in Table 2-1.

TABLE 2-1

SUMMARY OF WASTES DUMPED IN THE SOUTHERN CALIFORNIA AREA

TYPE OF WASTE	PERIOD	1931-1972 ESTIMATED TOTAL (Tons)	1973 ESTIMATED TOTAL (Tons/Yr)
Industrial Wastes	1947-72	10,500	195
Refinery Wastes	1946-71	530,000	---
Trash and Garbage	1931-72	158,800	623
Filter Cake	1969-70	350,000	---
Oil Drilling Wastes	1966-70	3,300,000	---
Explosives	1945-70	NA	---
Radioactive Wastes	1946-68	NA	---
Miscellaneous	1931-72	NA	250

2.2.1 Industrial Wastes

The main sources of industrial wastes are; (1) industrial, medical, institutional, and academic laboratories; (2) heat-

treating, plating, and film processing plants; (3) chemical and petroleum processing plants, and (4) electronic and aerospace manufacturers. Typically, these materials have been handled either as containerized or bulk wastes. Of the containerized wastes, between 1965 and 1971, 510 tons per year were dumped in the San Pedro Channel. Between 1960 and 1967, 155 tons of bulk sodium cyanide were dumped west of San Diego. These two activities have been curtailed. Bulk disposal activity is presently located at a site north of Santa Catalina Island, with amounts of approximately 195 tons per year. Dumping at this site has been active since 1960.

2.2.2 Refinery Wastes

It has been estimated that 530,000 tons of refinery wastes were dumped into the Southern California Area from 1946-1971.(1) Annual rates for 1968 to 1971 were approximately 2000 tons. The majority of this material was dumped in the San Pedro Channel. Information on the composition of this material is not available. These wastes can contain petro-chemical solvents and chemicals, catalyst waste, cleaning wastes, and oil and grease. Refinery wastes are not presently dumped in the Southern California area.

2.2.3 Refuse and Garbage

This catagory of waste is one of the two that are still actively being disposed of in the waters of the Southern California area. The U.S. Navy, between 1944 and 1970, dumped about 107,000 tons of garbage and trash from vessels in San Diego and Long Beach in two areas.(1) This dumping has been terminated and the material is now incinerated and disposed of at land fill sites. Since 1931, approximately 51,000 tons of trash and garbage collected from commercial vessels in Long Beach and San Pedro Harbors have been dumped in a site southeast of Santa Catalina Island. This enterprise is presently disposing of approximately 623 tons of waste annually in the same site.

2.2.4 Filter Cake

A residue of algin extraction from locally harvested kelp, filter cake consists of half perlite and half cellulose. Approximately 350,000 tons of filter cake were disposed of during 1969 and 1970 in an area west of San Diego, before the dumping was prohibited in 1970.

2.2.5 Oil Drilling Wastes

Muds and cuttings derived from oil well drilling were disposed of at sea during the period 1966 through 1970. Approximately 3.3 million tons were disposed of in the San Pedro Channel until the practice was prohibited in 1970. The muds can contain oils,

chemicals, heavy amounts of clays in suspension, and barite. This method of disposal has apparently been discontinued.

2.2.6 Explosives

In 1971, the disposal of military explosives at sea was interrupted by the U.S. Navy and it is present policy not to allow such disposal. It has not been possible to determine any amounts for materials dumped between 1944 and 1971. Small amounts of ammunition have been disposed of on an irregular basis by various police agencies.

2.2.7 Radioactive Wastes

Amounts of radioactive wastes disposed of in designated areas at sea off the Southern California Area were not determined. This material was disposed of during a period of 1946 through 1968, until the prohibition of such methods of disposal in 1968.

2.2.8 Miscellaneous Wastes

Disposal of slugs found in telephones, weapons collected by police agencies, and similar materials has, by one estimate, been placed at 275 tons per year.(1) Some of the material is disposed of at the site used for garbage and trash disposal. The Los Angeles Police Department recently applied for permit applications to dump four to five tons of contraband, weapons, and deactivated ammunition, but has not submitted a permit as of

this date. Recent contact has determined they have found an alternate method of disposal.(2)

2.3 SUMMARY

Problems generated by the present and past ocean dumping in the Southern California area are varied in complexity because of the lack of knowledge about the effects of some materials. The industrial wastes that are presently disposed of include some very toxic (cyanide wastes) and some highly reactive (phosphorous) materials. The composition of the material to be disposed of leads to problems in personnel safety and detrimental effects upon the site environment. Present methods of disposal in this area are very crude and can, therefore, accentuate these problems. The composition of the garbage and trash, with some nonbiodegradeable (plastics) and some floatable materials (wood), causes problems with esthetics and the introduction of undesirable materials into the ocean environment.

A lack of knowledge of munitions disposal amounts, types, and locations requires a larger area to be quarantined for disposal of this type of waste than may actually be required. Also, the future effect upon the ecology of the site is not determinable because of the lack of information on degradation of the containers of this waste.

Any future or continuing disposal must be closely analyzed for appropriate site location, allowable amounts and concentrations of materials, and disposal methods in order to comply with the present public health, public safety, and the environmental objectives for the local area, after all alternatives are rejected in order to preclude adverse reaction from any source. California State Law requires that these decisions be made in a public forum and that all information be made available to the local public audience.

2.4 PRESENT DUMPING ACTIVITIES

Present dumping in the Southern California area is concentrated in two areas west of Los Angeles. The materials, generally described, are industrial wastes and garbage and trash from commercial vessels. A site east of San Diego may be used for the disposal of dredge spoil in future dredging of San Diego Bay, but is not included in this report as it is not an active site at this time.

2.4.1 Environmental Characteristics of the Study Area

Biology

The industrial waste disposal site is centered over the sill between the Santa Monica and San Pedro Basins. The garbage and trash disposal is centered on the lower slope into the southern end of the San Pedro Basin. Basins in Southern California are

characterized as impoverished areas, as are the slopes below the sills of the basins. Both the Santa Monica and San Pedro Basins have large areas of impoverishment below their combined sill depths of 2418 feet (737 meters).

These basins are connected in such a way that the same sill controls both. The bottoms of both basins are barren of living benthic animals. Table 2-2 shows the results of sampling (69 samples) in the basins in percentage of dead animals and wet biomass at depths above and below the sill depth.[3]

TABLE 2-2

SANTA MONICA AND SAN PEDRO BASINS
BIOLOGICAL SAMPLING RESULTS

DEPTH (ft)	DEAD (%)	BIOMASS (g/sq m)
1762-1925	0	30+
1925-2090	0	30+
2090-2254	0	30+
2254-2418	0	30+
2418-2582	19	21
2582-2746	35	15
2746-2910	91	0
2910-3074	100	0

Impoverishment is a result of the low oxygen content of the bottom water and interstitial water. The low oxygen content of

the bottom water is a reflection of the position of the sill within the oxygen minimum in the open sea.(3) Because of the low oxygen content of the overlying water, organic debris reaches the bottom in an incomplete stage of decomposition which depletes the interstitial water of oxygen and causes the condition found at the bottom of the basins, that of an anoxic environment.

Above sill depth, animals dominating are siliceous sponges and ampharetid worms, but include ophiuroids, crustaceans, and mollusks. The benthic forms are very well represented in the waters on the slopes of basins above sill depth. One study(4) conducted of the benthic fauna of the Southern California shelf revealed 1473 different species composed predominately of polycheates, crustaceans, mollusks, and echinoderms. The polycheates are the most important single group.

Diatoms were the predominant type of phytoplankton found in the waters off Southern California. Their numbers will often exceed a million cells per liter of water. Some of the more common genera are Coscinosina, Leptoclindrus, Rhizosolenia, Nitzschia, Chaetoceros, and Ditylum. Species of the genus Chaetoceros were the most frequently observed diatom. More than 60 species, representing 27 genera, have been identified in the coastal waters of Southern California.(4) Dinoflagellates are also very abundant. The more common genera are Prorocentrum, Ceratium, and

Goniaulax. Prorocentrurum micans was the most abundant dinoflage llate found. Blooms (50,000/liter or more) of these organisms have occurred periodically during the summer months and are known as red tides. Certain species may poison filter feeders such as mussels, clams, and oysters and may be harmful or toxic to humans who ingest them. Catastrophic death of fishes has been attributed to blooms of dinoflagellates. Twelve genera of dinoflagellates have been observed with eleven species identified.(4) Coccoliths and silicoflagellates are also found in the waters off Southern California; however, they are not of common occurrence. The chief genera are Coccosphaera, Rhabdosphaera and Dictocha.

The bulk of the zooplankton consists of five groups which represented approximately 75 percent of the population. These groups are the Copepoda, Thaliacea, Euphausiacea, Siphonophora, and Chaetognatha.

The zooplankton also included protozoans (tintinnids, ciliates, flagellates and Foraminifera), cladocerans, tunicates and various larval forms and eggs. The copepods were the dominant group.

The nekton or swimming organisms (fish, seals, whales) are very well represented in the waters off Southern California. The plankton-rich waters support a variety of fish in relatively

large numbers. At least 189 species representing 71 families and 16 orders, have been identified.(*) Several kinds of sea mammals are found, including seals, sea lions, sea otters, sea elephants, whales, dolphins, and porpoises.

Important fish and shellfish contributing to the California commercial fisheries in this area are tuna, anchovy, mackerel, bonita, rockfish, squid, crabs, and abalone. A bountiful sardine fishery once existed; however, because of overexploitation this fishery no longer exists.

TABLE 2-3

PHYSICAL AND CHEMICAL PROPERTIES
AT DUMP SITES

PROPERTIES	INDUSTRIAL	GARBAGE SITE
Temperature (°C)		
Surface	13-20	13-20
200 meters	8-9	8-9
Bottom	5.0	5.0
Salinity (°/oo)		
Surface	33.3-33.6	33.3-33.8
Bottom	34.31	34.29
Dissolved Oxygen (mg/L)		
Surface	8.0	8.0
Bottom	0.3	0.2

Physical and Chemical Oceanography

The physical and chemical properties of the Santa Monica and San Pedro basins are shown in Table 2-3. These are average annual values, with ranges where data was available.[3][5][6]

Off southern California the onset of strong, steady, northerly winds blowing in the late winter move the warm surface water to the west and permits colder (denser) water to well up near the coast. This water brings up nutrients, which support heavy plankton blooms and cause the area to be one of high organic production. The resulting redistribution of mass maintains a geostrophic current directed southward.[6]

The California Current (Figure 2-2), typical of astern boundary currents, is best described as a meandering, diffused southeastward flow, with short-term variations in speed that are of the same order as the mean speed itself. The current, which

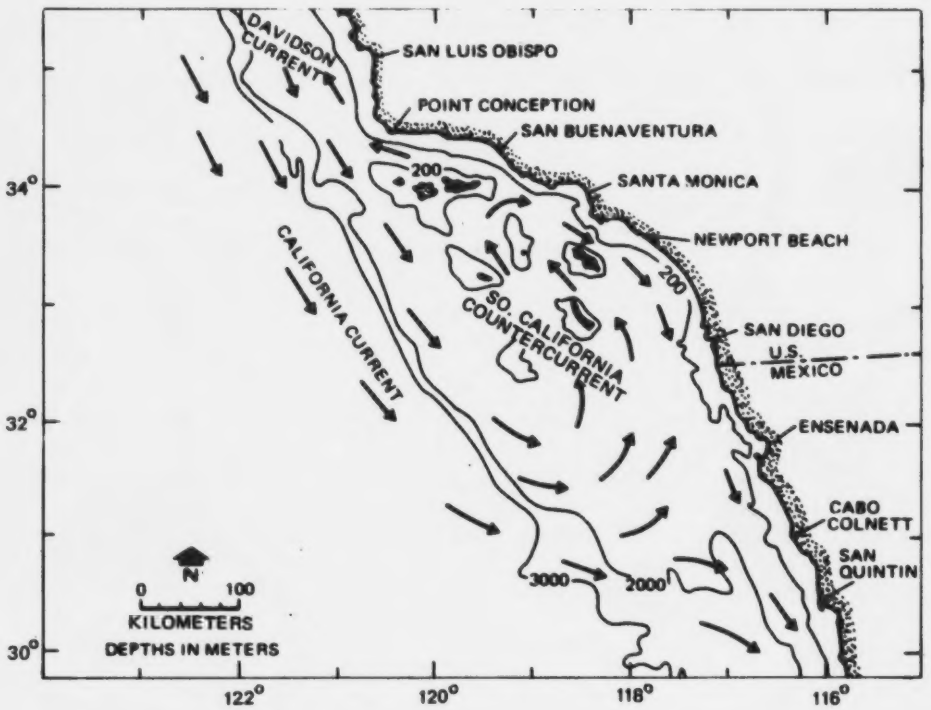


FIGURE 2-2 SURFACE (0-100 Meters) CURRENT FLOW IN THE SOUTHERN CALIFORNIA AREA

is a continuation of the westerly drift in the North Pacific, starts its southward flow near the Canadian border and initially contains water characteristic of the subarctic. As this water moves southward, the surface characteristics are modified by solar heating, by upwelling, and by the effects of river inflow and exchange with estuaries and embayments. The flow generally follows the coastline until it reaches Point Conception. Here, the coastline turns abruptly eastward, and the flow of water departs from the coast, generally continuing in a southeastward direction. Farther south, off the coast of northern Baja California, the main portion of the current turns toward the land, and the flow divides into two branches. One branch, known as the Southern California Countercurrent, turns northward and flows through the Channel Islands, forming the inshore side of the Southern California Eddy. The second branch turns westward and contributes to the North Equatorial Current.(6)

The Southern California Eddy, a nearly permanent feature of the flow pattern, is seasonal in character. The eddy is usually well developed in summer and autumn and weak (and occasionally absent) in winter and spring (Figure 2-3).

Most of the present knowledge about circulation in Southern California waters is based upon information from programs not specifically intended to deal with the dispersion of pollutants

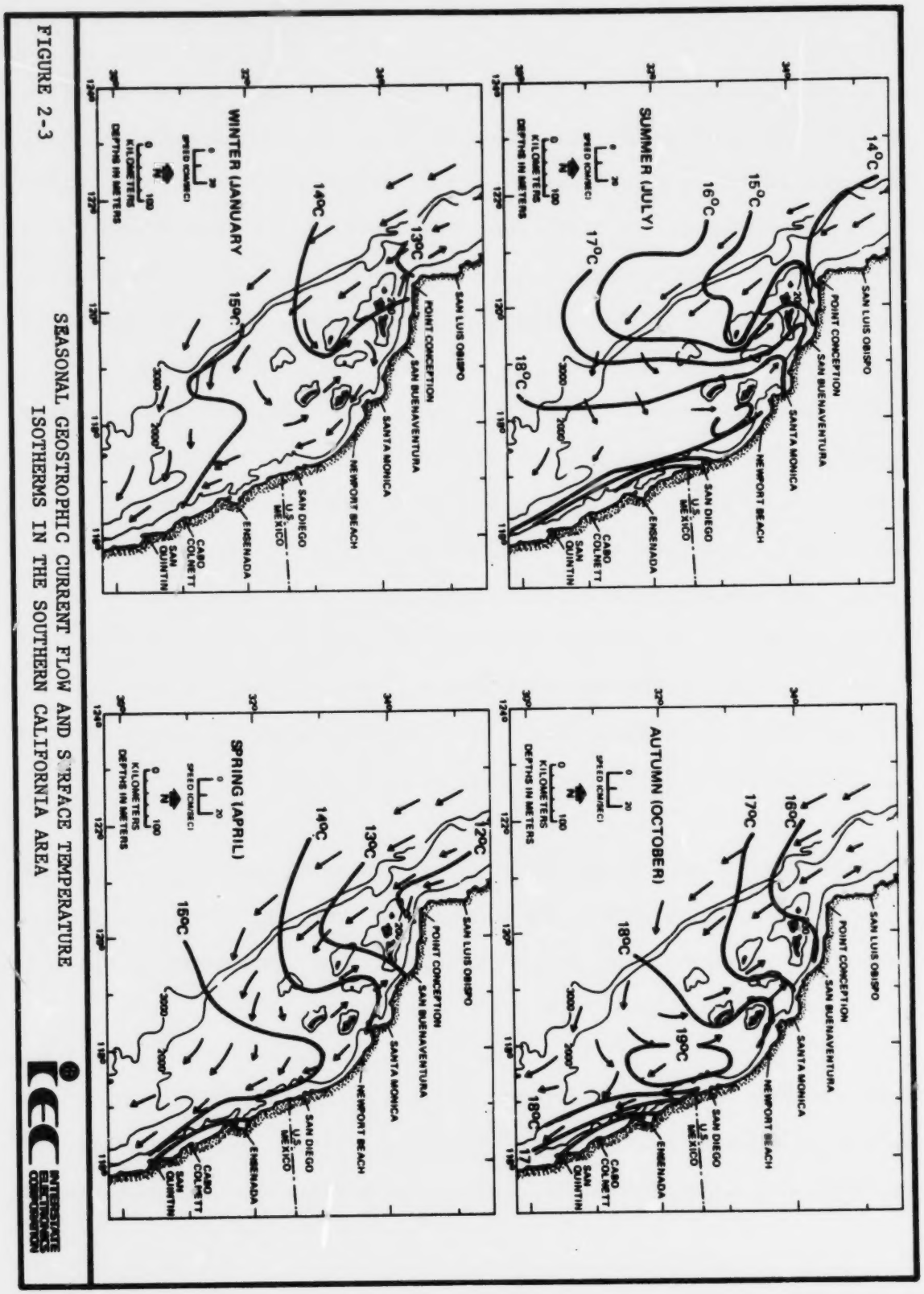


FIGURE 2-3 SEASONAL GEOSTROPHIC CURRENT FLOW AND SURFACE TEMPERATURE ISOTHERMS IN THE SOUTHERN CALIFORNIA AREA

as they enter the ocean environment. We have knowledge of the average seasonal variations of some oceanographic parameters, and some data on the monthly variations are available; however, pertinent information is missing regarding the small-scale, horizontal eddy structures, which are important in describing lateral mixing as well as in determining the residence time of a parcel of water or the half-life of a substance in the area.(6)

Evidence has indicated that the flow in the California Current is highly responsive to the influence of the winds; however, no adequate study aimed at predicting changes in the flow pattern has been attempted to date.(4)

The nature of the California undercurrent (Figure 2-4,), especially off Southern California, is not at all well understood. It has been suggested that the Davidson Current is a surface manifestation of this flow occurring north of Point Conception.(4)

Circulation of the waters of Southern California is best represented by a series of figures from a Southern California Coastal Water Research Project Report.(4) Figure 2-2 shows surface (0-100 meters) current flows, Figure 2-3 seasonal geostrophic current flow and Figure 2-4 mean geostrophic (at 200 meters) current direction and magnitude.

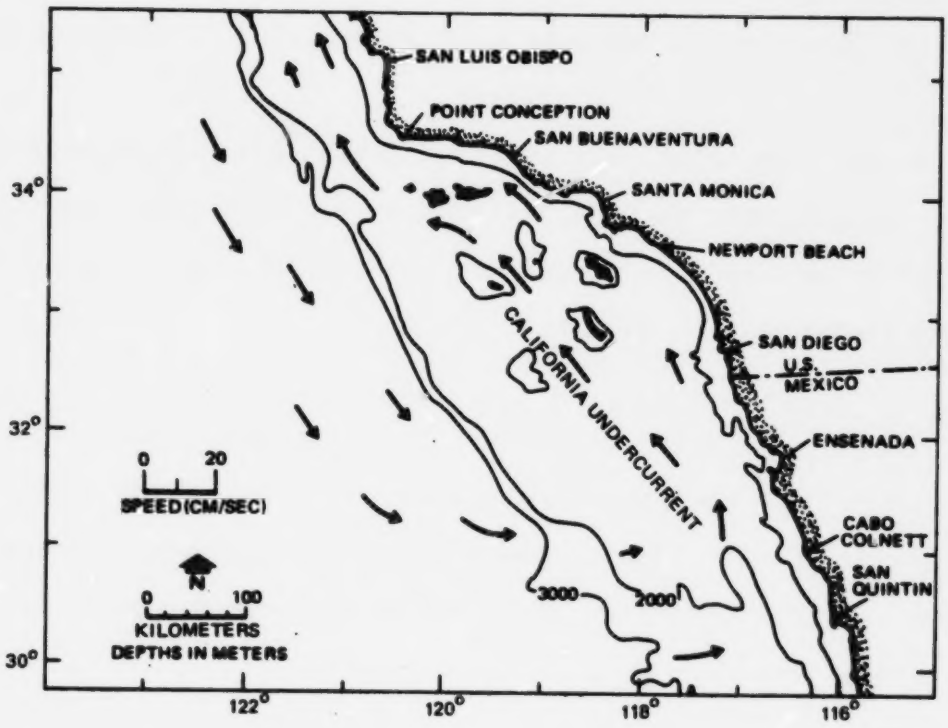


FIGURE 2-4 MEAN GEOSTROPHIC FLOW AT 200 METERS IN THE SOUTHERN CALIFORNIA AREA

Climatology

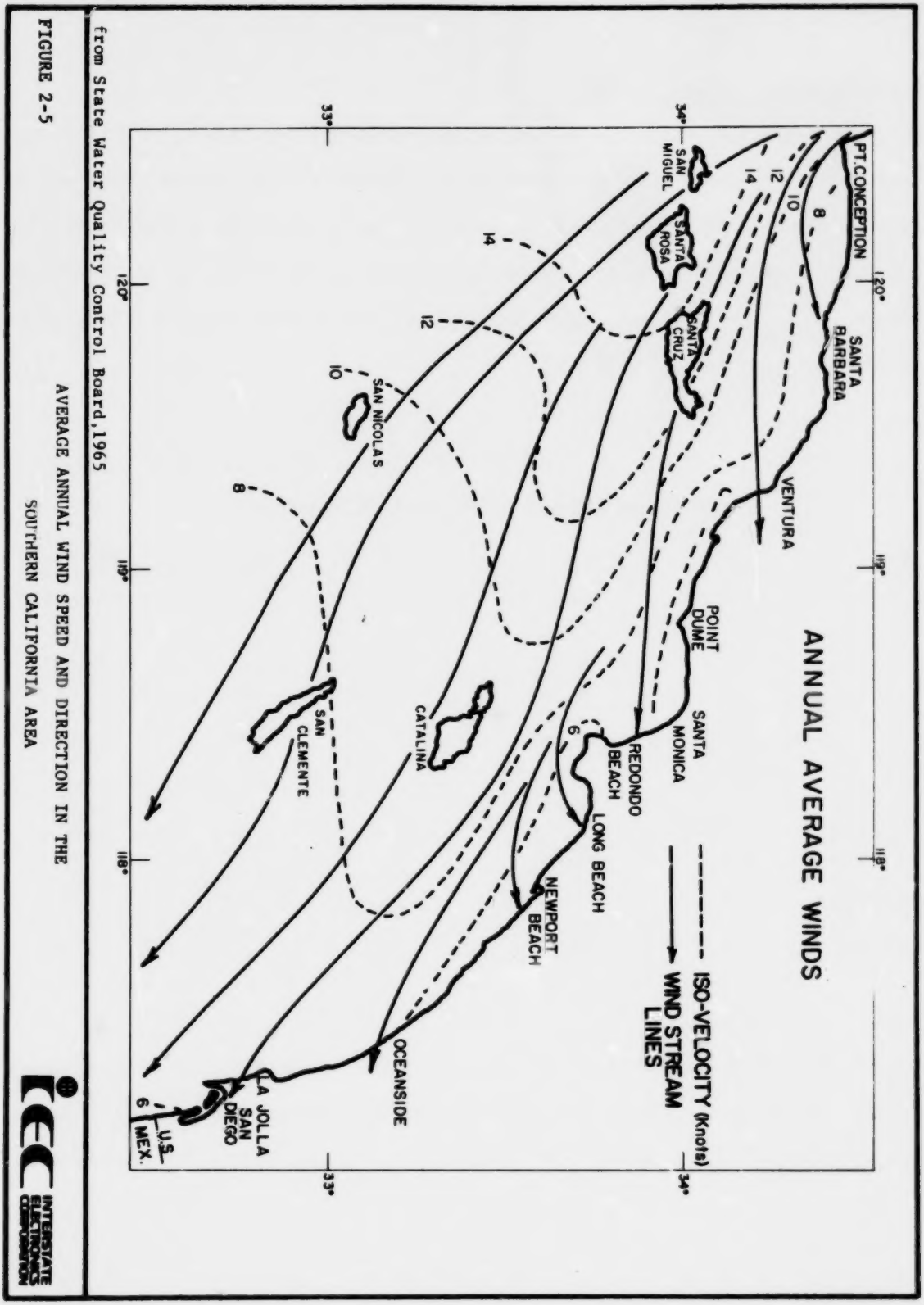
The Southern California climate is a Mediterranean-type climate, with warm summers and mild winters. Summers are almost rainless and winter storms are generally mild, with only occasional heavy rains and rare snowfall. Meteorological conditions on a monthly basis (averages) for the Southern California marine area are shown in Table 2-4.[5][6]

TABLE 2-4

SOUTHERN CALIFORNIA AREA CLIMATOLOGY

MONTH	AIR TEMP (°C)	PRECIPITATION (Inches)	WIND SPEED (mph)	WIND DIRECTION	SOLAR RADIATION (btu/ft²/d)
January	57.5	2.54	5	WNW	1300
February	58.5	2.68	5	WNW	1620
March	61.0	1.88	8	WNW	2070
April	62.5	1.44	9	NW	2500
May	64.0	0.28	10	NW	2800
June	66.0	0.11	10	WNW	2950
July	69.0	0.09	9	WNW	2850
August	73.0	0.14	9	WNW	2600
September	71.5	0.33	9	NW	2250
October	67.5	0.53	6	NW	1800
November	65.5	1.55	6	W	1400
December	60.0	2.36	6	W	1250
Annual	64.8	13.63	7.5	NW	2116

Wind speed and direction for the Southern California Area are shown in Figure 2-5 on an average annual basis. Figure 2-6 is a graph of average monthly rainfall at three stations in the area.



from State Water Quality Control Board, 1965

FIGURE 2-5 AVERAGE ANNUAL WIND SPEED AND DIRECTION IN THE SOUTHERN CALIFORNIA AREA

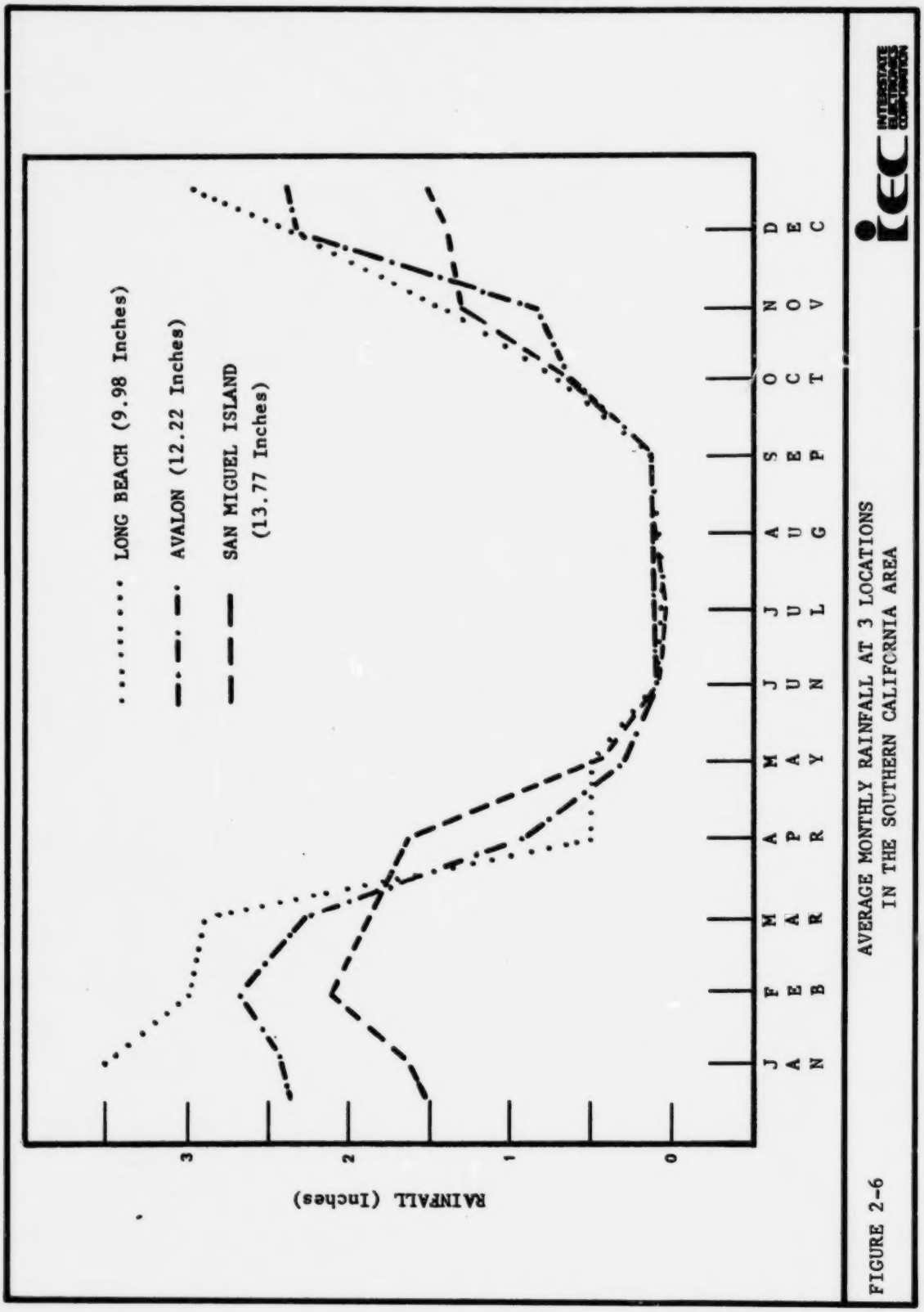

LONG BEACH (9.98 Inches)
AVALON (12.22 Inches)
SAN MIGUEL ISLAND
(13.77 Inches)
RAINFALL (Inches)
0
1
2
3
J F M A M J J A S O N D
A E A P A U U U E C O E
N B R R Y N L G P T V C

FIGURE 2-6 AVERAGE MONTHLY RAINFALL AT 3 LOCATIONS IN THE SOUTHERN CALIFCRNIA AREA

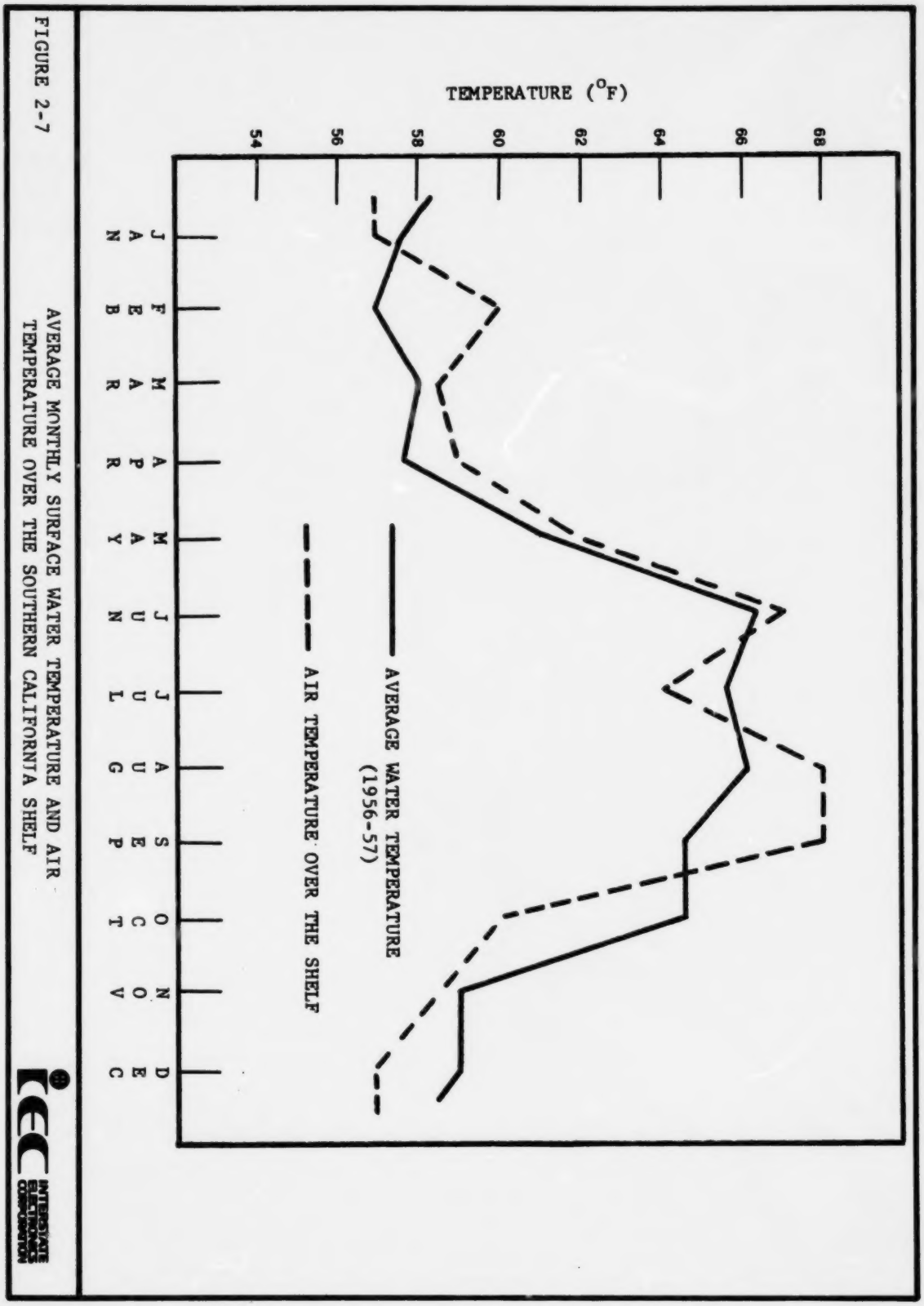


FIGURE 2-7 AVERAGE MONTHLY SURFACE WATER TEMPERATURE AND AIR TEMPERATURE OVER THE SOUTHERN CALIFORNIA SHELF

INTERNATIONAL ELECTRONICS CORPORATION

A comparison between air temperature and surface water temperature over the shelf (Figure 2-7) shows the effect sea temperature has upon the climate of Southern California.

Frontal storms produce all of the precipitation that is in the form of rain.(5) From April through August, sea fog conditions generate low visibility in the mornings and late afternoons, with partial to complete burnoff during late morning and early afternoon.

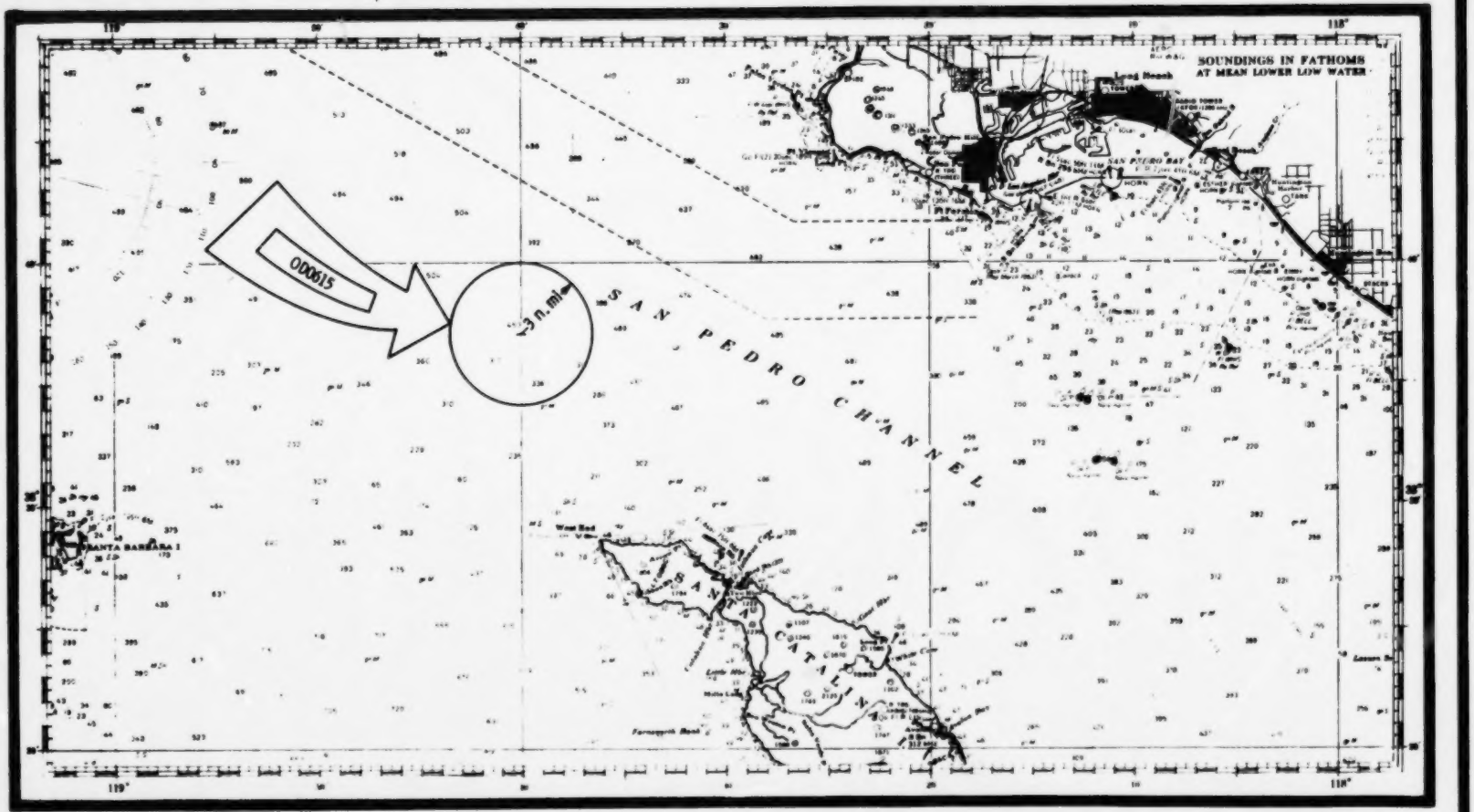
2.4.2 Site No. OD0615

This site, centered at 33°37'N latitude, 118°40'W longitude, is 19.7 nautical miles west of Point Fermin, San Pedro, and 9.2 nautical miles north of West End, Catalina Island. This site is presently used for the disposal of industrial wastes. A portion of National Ocean Survey map number 5101 with the disposal site displayed upon it is reproduced as Figure 2-8.

Site Description

The site covers a surface area of 28.27 square nautical miles. It is circular in shape and has a radius of three nautical miles. It has a depth of approximately 459 fathoms at the center with a minimum of 310 fathoms and a maximum of 500 fathoms. The site is in a location which experiences a generally northwest current.

SOUTHERN CALIFORNIA



Center Coordinates	33° 37' 00" N, 118° 40' 00" W
Area	28.26 Square Nautical Miles
Navigation Chart No.	NOS 5101
Local Navigation Aids	Loran A, Omega, RDF, Radar
Material Type	Industrial Wastes
Primary Management	EPA

INTERIM DISPOSAL SITE

September 1973

FIGURE 2-8

SITE NO. OD0615

INTERSTATE ELECTRONICS CORPORATION

The center of the site is located above the sill between the San Pedro and Santa Monica basins.

Users of the Site

California Salvage Company of Wilmington, California is the only recorded permittee using the location. The materials disposed of at the site are characterized as industrial waste by-products of an extremely noxious nature.(7) The records of the Los Angeles Regional Water Quality Control Board, the present permit managers, were examined and a compilation of three years of accumulated information on entities contracting for disposal services, waste amounts, and waste types was made. Table 2-5 is a summary of this information, categorized by type and volume. As shown by note 3, the information was analyzed in an attempt to minimize the data that falls into the two catchall categories, waste chemicals and unlisted materials. These categories were called catchalls because of a lack of information on waste types in the reports to the Regional Water Quality Control Board. There was an apparent lack of consistency in the reporting done by the dumper in order to meet requirements set forth as a part of the Regional Board permit program. The composition of the dumped materials cannot, from available data, be defined in an accurate manner. As best as can be determined, the major wastes are listed in Table 2-6 along with their possible source listed in order of frequency of appearance.

TABLE 2-5

3-YEAR SUMMARY OF DATA
CALIFORNIA SALVAGE COMPANY

TYPE OF WASTE	VOLUME OF WASTE Pounds (1)	PERCENT OF TOTAL (2)	(3)
Waste Chemicals	309,588	26%	13%
Waste Acid	238,484	20%	32%
Cyanide Wastes	206,471	18%	18%
Paint,Solvents	172,309	15%	15%
Unlisted Materials	83,038	7%	6%
Waste Nitrate Film	57,400	5%	5%
Sodium Metal	54,566	5%	5%
Beryllium Waste	40,102	3%	5%
Miscellaneous Wastes	10,709	1%	1%
3-YEAR TOTAL	1,172,667	100%	100%

Notes:

1. the gallonages of the materials in liquid state were converted to pounds at a factor of 8.3 lbs per gallon.

2. Percentiles shown are on data before trying to obtain a better fit in the ambiguous categories, miscellaneous wastes, wastes chemicals, etc; these are apparently catchall categories in the report data.

3. Percentages shown are on data after attempting to fit the data. Rationale used was, if a company at most times disposed of a certain type of material, on the unlisted or waste chemical types, it would be accepted as the best fit data.

TABLE 2-6

CHEMICALS DISPOSED OF BY CALIFORNIA SALVAGE

CHEMICAI WASTE	SOURCE INDUSTRIES
Beryllium	Aerospace, Medical Mfg.
Cyanide	Aerospace, Plating, Medical Labs.
Acids	Aerospace, Medical Labs.
Solvents	Aerospace, Research Labs, Chemical Co.

Operational Description

Waste chemicals are stockpiled at a shore facility until sufficient quantities of materials are on hand to fill the stern of the tugboat, Edna. Materials in breakable containers are put inside larger containers to guard against breakage in transit to the dumping site. The stern area of the tug is loaded to capacity. A crew consisting of the captain, a foreman, and several laborers is on board for the operation. Navigation is by dead reckoning. Upon arrival at the site, the vessel is idled in a circular course. Breakable containers are individually broken over the side manually and metal containers are holed with a fire-axe until they sink. Metal containers with liquid contents are partially emptied from the deck before pushing over the side and holed until they sink. No materials are left floating on the surface. This disposal (on site) takes on the order of five hours. Transit time is four hours.

An observer from the Los Angeles Regional Water Quality Control Board has made a trip on one dumping operation. He noted that a lot of the small containers were filled with what appeared to be laboratory chemicals that had outlived their normal shelf life. Some materials came from as far as San Francisco, and the operation appeared to be a statewide disposal point. (In all previous reports to the Board, the farthest noted area furnishing materials was San Diego.) Containers varied from cartons to 100-pound sacks, and from test tubes to 55-gallon drums. Some materials have exploded upon contact with the water.(8)

Site Managers

The Los Angeles Regional Water Quality Control Board has been the governmental overseer of the California Salvage operations since 1961. In October of that year the Board under authority of the California Water Code, Division 7, placed restrictions, requirements, and standards upon the continuance of the California Salvage dumping operations.(7)

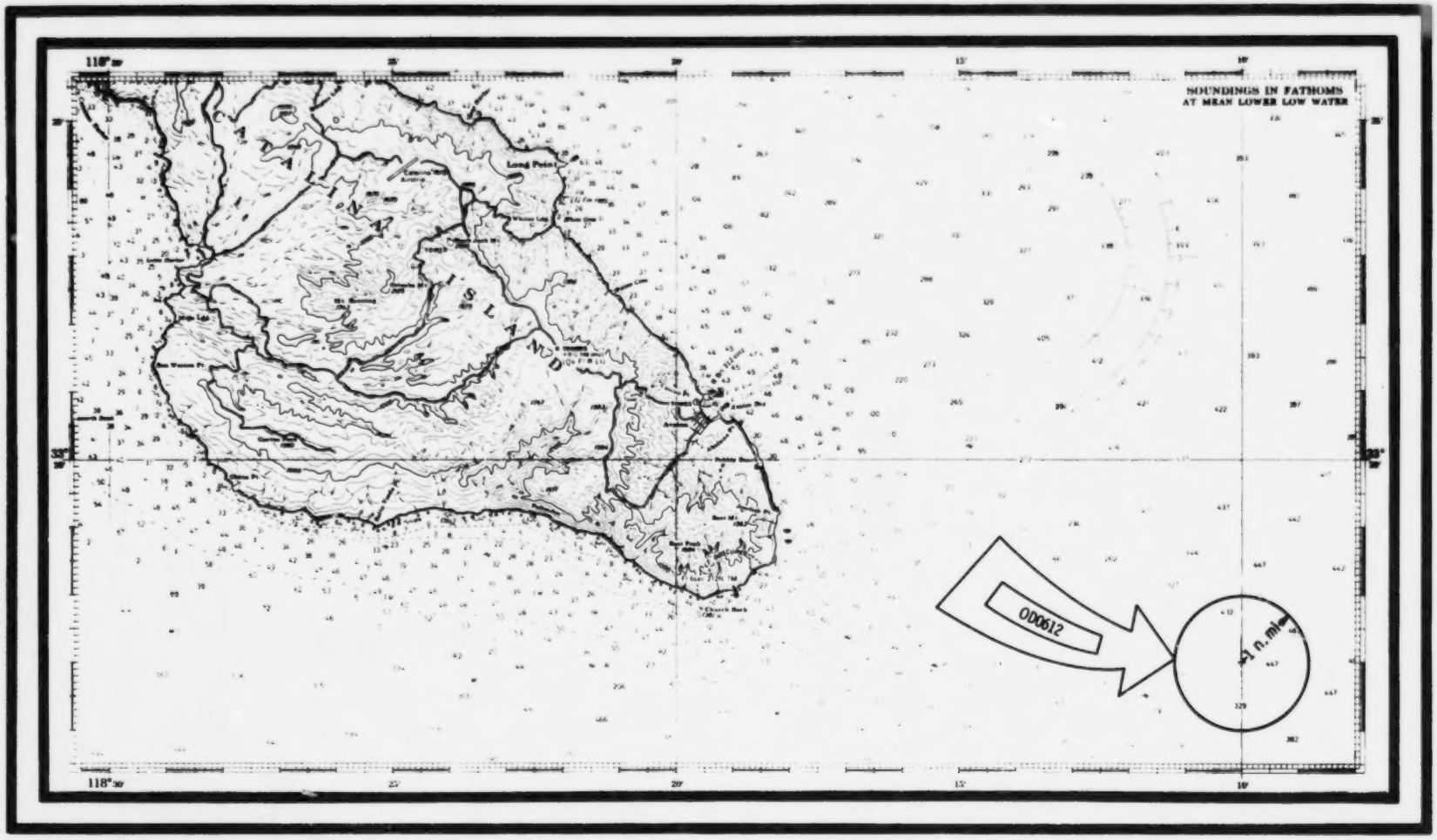
California Salvage was restricted to the use of one area defined by the Board. They were required to submit reports on a scheduled basis, store wastes on shore so as to preclude spillage in harbor waters, and comply with all other governmental ordinances that could pertain to the operation. Also, the discharge was not to cause the presence of floating oil or the

appearance of floating or suspended matter. Records of all wastes received were to be kept regarding type, producer, and quantity of the waste and the records were to be certified by the producer, hauler, and operator and submitted every two months to the Board. Logs of each trip were to be maintained and submitted on the same schedule. The records inspected do not show a strict compliance with the intent of the resolution. A lack of detail in all three categories was noted. Producer addresses were not always filled in, type of waste was at best described in rudimentary terms, and amounts of wastes were often not in usable terms to describe actual amounts, much less concentration of the chemicals.

2.4.3 Site No. OD0612

Just 7 miles east of the south end of Santa Catalina Island, and 24 miles southwest of the mainland of Orange County, is the location of a disposal site for garbage and trash collected from commercial vessels entering Los Angeles Area harbors from foreign ports. The site is plotted on a portion of National Ocean Survey Chart No. 5142 and is shown as Figure 2-9.

SOUTHERN CALIFORNIA



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INTERIM DISPOSAL SITE

Center Coordinates	33° 17' 00" N, 118° 10' 00" W
Area	3.14 Square Nautical Miles
Navigation Chart No.	NOS 5142
Local Navigation Aids	Loran A, Omega, RDF, Radar
Material Type	Garbage & Trash
Primary Management	EPA

FIGURE 2-9

SITE NO. ODO612

September 1973

2-30

INTERSTATE ELECTRONICS CORPORATION

Site Description

This circular site of 1-mile radius is centered at 33°17'N, 118°10'W in about 400 fathoms. It covers a surface area of 3.14 square nautical miles and has a minimum depth of 220 fathoms and a maximum depth of 460 fathoms. The site is located over the slope into the southern portion of the San Pedro Basin caused by the Santa Catalina Island rise. Currents in the area of the disposal site are of an eddy nature that appear to be associated with island topographic influences on the generally northern flow of the California Counter-current.(9)

Users of the Site

H-10 Water Taxi Company, Ltd. of San Pedro, California, is currently using the dump site. Materials disposed of by H-10 are garbage and trash collected from commercial vessels that call at Long Beach and San Pedro Harbors. The dumper operates under a permit from the California State Department of Agriculture (No. 2030 Vessel and Aircraft Garbage Collection), which is intended to prevent the import of dangerous animal diseases. Also, they are operating under a California Water Resources Control Board waste discharge requirement,(10) issued by the Los Angeles Regional Water Quality Control Board.

The materials consist of domestic garbage typical of home garbage, and trash typical of ship-generated trash. Garbage

consists of residue, generally from cooking (wet garbage). Trash consists of paper, cartons, cans, bottles, waste dunnage, metal parts from repairs, rope scraps, rags, old clothes, and similar wastes. Occasionally, H-10 discharges small amounts of industrial wastes in sealed weighted containers, typical of a recent disposal of slugs obtained from telephones in the Los Angeles area.

H-10 Water Taxi has been dumping at this site since 1931. Present annual amounts disposed of average about 623 tons, and vary by large amounts from year to year. For example, in 1971 when numerous ships were idled in the harbors because of a longshoreman strike, approximately 750 tons of waste were collected and dumped, while in 1972 the rerouting of ships from West Coast ports because of the strike caused a reduction in tonnage to 570 tons. Records from reports to the Los Angeles Regional Water Quality Control Board for 1971 and 1972 are shown as Tables 2-7 and 2-8, respectively. The tables show the dates trips were made to the site, and amounts of garbage, trash, and other material that were dumped on that date. The tables also show the variation in annual amounts (the 1971 records show 31 trips and the 1972 records only 19 trips). Neither of these years can be considered typical, but this data is all that is now available for review at the Board office. Analysis is made

difficult due to the lack of a suitable conversion factor between yards and tons.

TABLE 2-7

H-10 WATER TAXI COMPANY
DUMPING REPORTS 1971

DATE	GARBAGE (Tons)	TRASH (Yds)	
1 FEB 71	25 Ton	10 Yds	
18 FEB 71	25 "	10 "	
3 MAR 71	20 "	4 "	
8 MAR 71	25 "	8 "	
8 APR 71	25 "	10 "	
8 JUN 71	25 "	10 "	
24 JUN 71	25 "	10 "	
21 JUL 71	25 "	8 "	
27 JUL 71	25 "	10 "	
11 AUG 71	25 "	10 "	
17 AUG 71	25 "	10 "	
24 AUG 71	25 "	10 "	
26 AUG 71	25 "	10 "	
7 SEP 71	25 "	8 Yds	
15 SEP 71		4 Ton	(Slugs from Telephone Co.)
22 SEP 71	25 Ton	10 Yds	
7 OCT 71	25 "	10 "	
12 OCT 71	25 "	10 "	
14 OCT 71	25 "	10 "	
19 OCT 71	25 "	10 "	
25 OCT 71	25 "	10 "	
27 OCT 71	25 "	10 "	
2 NOV 71	25 "	10 "	
11 NOV 71	25 "	10 "	
16 NOV 71	25 "	10 "	
23 NOV 71	25 "	10 "	
30 NOV 71	25 "	10 "	
6 DEC 71	25 "	10 "	
16 DEC 71	25 "	10 "	
24 DEC 71	25 "	10 "	
29 DEC 71	20 Ton	10 Yds	

TABLE 2-8

H-10 WATER TAXI COMPANY
DUMPING REPORTS 1972

DATE	GARBAGE	TRASH
9 JAN 72	45 Ton	1.25 Ton
30 JAN 72	40 "	1 "
22 FEB 72	40 "	3 "
24 FEB 72	30 "	0.5 "
7 MAR 72	30 "	1 "
1 APR 72	30 "	2 "
22 APR 72	20 "	1 "
18 MAY 72	25 "	1 "
31 MAY 72	30 "	2 "
15 JUN 72	30 "	1 "
27 JUN 72	30 "	2 "
3 JUL 72	20 "	2 "
25 JUL 72	25 "	3 "
14 AUG 72	20 "	2 "
17 SEP 72	30 "	4 "
21 OCT 72	20 "	3 "
4 NOV 72	30 "	4 "
29 NOV 72	30 "	3 "
15 DEC 72	25 Ton	4 Ton

Operational Description

H-10 collects garbage in San Pedro and Long Beach Harbors on a call basis. Material is stored in metal containers on board the vessel M/V Ramona until a full load is received. The vessel, using dead reckoning navigation, proceeds to the site and manually unloads the materials. Containers are flushed overboard. A representative of the Los Angeles Regional Water Quality Control Board has made a trip with H-10. He reported that most materials sank during the time the boat was unloading, with only some wood and plastic bottles left floating.(11) A

California Fish and Game Department warden-pilot, in a report on an apparent violation because of dumping at other than the required location, reported observing cardboard, tin cans, and a white powder floating on the surface.

Site Managers

H-10 has been operating under Permit No. 2030 issued by the California State Department of Agriculture since 1931.(12) In addition, the Los Angeles Regional Water Quality Control Board effected discharge requirements on the disposal operation in February 1971.

State and Federal Regulations

The disposal of garbage from vessels is subject to control by the California State Departments of Public Health and Agriculture, and by the United States Department of Agriculture. Among the control provisions of significance are the following:

a. The dumping of garbage in or upon the navigable waters of the state, or at any point in the ocean within 20 miles of its coastline, is a misdemeanor. (California Health and Safety Code, Chapter 4, Article 1, Section 4401.)

b. The removal of garbage from any vessel for dumping into any territorial waters or onto land is prohibited except for immediate incineration, approved treatment

or disposal under supervision of the Director of the State Department of Agriculture, or delivery to a garbage collector licensed by the director or the Federal Government (California Agricultural Code, Division 8, Chapter 4, Section 16151).

c. Section 774 of the California Administrative Code permits, as an approved method of garbage disposal, reduction to a liquid state by grinding and discharge into seawater; location and distance from shore of such approved disposal are not specified.

These and equivalent restrictions enforced by the United States Department of Agriculture are intended to prevent hoof-and-mouth disease, rinderpest, and other highly contagious diseases which can infect cattle, sheep, or swine.

Los Angeles Regional Board Regulations

The Los Angeles Regional Water Quality Control Board under provisions of the California Water code has set the following waste discharge requirements on disposal of these materials at sea:(10)

a. Disposal of wastes shall be prohibited into or onto any waters of the state (within three miles of shore.)

b. Disposal of wastes shall be prohibited into, onto, or within any place or waters from where they can affect the waters of the state.

c. Disposal of wastes into the ocean, as proposed, shall be limited to the locations herein before described; that is, within a radius of one nautical mile of either latitude 33°17'N, longitude 118°10'W (prime site) or latitude 32°33'30"N, longitude 119°05'48"W (alternate site).

d. The disposal of wastes shall not impair any of the beneficial uses of the offshore coastal waters enunciated for protection by this Board in its Pacific Ocean Water Quality Control Plan.

e. This waste discharge shall not cause the appearance of visible oil or oily slick or any other floating or suspended matter in waters of the state or along beaches or shores.

f. The disposal operation shall be conducted in such a manner that no trash, garbage, or other waste material will be deposited along beaches or be present in waters of the state.

g. Wastes discharged shall not cause concentrations of toxic materials at any point within coastal waters which would be detrimental to human, animal, fish, plant, or bird life.

h. Wastes discharged shall cause no odors at any point within the coastal waters, or along the shore.

i. Wastes discharged shall not cause any increase in turbidity within waters of the state.

j. Wastes discharged shall not cause dissolved oxygen concentrations in waters of the state to fall below 7.0 mgl as an annual average, and shall not cause such concentrations to fall below 5.0 mgl at any time.

k. Waste handling and loading operations shall be conducted in a manner that will prevent spillage or dropping of any waste material into waters of the state.

l. Handling, storage, or disposal of wastes shall not cause pollution or nuisance.

m. All Federal, State, County, and City rules, regulations, laws, and ordinances pertinent to this disposal of wastes shall be complied with.

n. Adequate facilities shall be provided to handle and store wastes without spillage or leakage, pending disposal.

o. Upon verbal request by Board staff, the discharger shall notify the Board at least 24 hours prior to the departure of the disposal vessel so that an observer may accompany the vessel.

p. Complete logs of all trips for purposes of waste disposal shall be kept and shall be available for inspection during regular business hours by the Board staff. These shall include names of vessel and captain, times of departure and return, and latitude and longitude of disposal point, and vessel speed.

q. A copy of these waste discharge requirements shall be made available at all times to personnel conducting waste disposal operations.

r. In accordance with Section 13260 of the Water Code, the discharger shall file a report of any material change or proposed change in the character, location, or volume of the discharge.

s. A report of any change or proposed change in ownership or name of this facility shall be filed with the Board.

t. The Board shall be notified immediately by telephone of the presence of adverse conditions resulting from this discharge; written confirmation shall follow.

u. In accordance with Section 13267 of the Water Code, furnish, under penalty of perjury, technical reports shall be submitted in accordance with specifications prepared by the Executive Officer, which specifications are subject to periodic revisions as may be warranted.

The technical reports required are submitted quarterly and contain quantities and types of materials, dates of discharge, sums of quantities discharged during period covered by report, a separate accounting of industrial wastes hauled (if any), a copy of the log on each trip made during the report period, and any deviations from the discharge requirements noted. Also, an annual report is submitted covering all the above information.

The Regional Board has sent an observer on at least one trip with H-1(to assess the disposal operation. Several complaints, one by the Board and one by the California Department of Fish and Game, have been voiced. Neither complaint led to any legal action, but administrative inquiries were initiated. In each case, the dumper was able to guarantee that no further problems would arise and that settled both inquiries to the satisfaction of the Board.

2.5 ANALYSIS OF SOUTHERN CALIFORNIA DUMPING OPERATIONS

An analysis of problems connected with the California Salvage Company and H-10 Water Taxi Company, Ltd. disposal operations, alternatives to the disposal of wastes at sea, and recommendations for future use are topics covered by this section.

2.5.1 Problems

The problems associated with the disposal of wastes by the two operators, California Salvage Co., and H-10 Water Taxi Company, Ltd. are separated into two parts for clarity.

California Salvage Company

Methods used by California Salvage Company for the disposal of the material they are authorized to dump at sea has several negative aspects.

a. Surface disposal of toxic liquid wastes affects the most productive area of the water column. Natural mixing rates of liquids of dissimilar densities are slow unless externally agitated. Most water-chemical solutions are only slightly heavier than water and, therefore, would sink slowly through the trophic zone. This could adversely affect marine life if the chemicals were in toxic concentrations.

b. Some of the chemicals are highly reactive with water (phosphorous for example) and can cause physical damage to marine life resulting from explosions, thermal reactions with the water, or by direct contact with marine life.

c. Some of the containers are of a nondegrading material (PVC) and would cause burial of bottom-dwelling life

and permanent substrate alteration. A PVC artificial reef in 400 fathoms, in an oxygen-low environment is not desirable.

d. Physical methods of disposal now used are not the ultimate from a public safety standpoint. Physical harm can be caused by a lack of knowledge about specific chemicals coupled with improper handling. It is fortunate that nothing has been reported to date to have caused harm to any person in the operation. Inhalation of beryllium dusts, a material disposed of by California Salvage, can cause lung diseases when exposed to concentrations less than 1 to 100 micrograms per cubic meter of air.(13)

e. Navigation procedures used by California Salvage (dead reckoning) are rudimentary. The length of time they are on site (4-5 hours), with no checks on position, certainly leads to doubts about staying within the area provided for a dump site.

H-10 Water Taxi Company

Problems associated with the H-10 dumping operation are generally more of an esthetic nature than those of California Salvage. The major portion of the materials disposed of probably have little effect if any, upon marine life at the dump site. Wood, plastic

bottles, clothing, rags, metal parts, and similar items of trash that would not transmit animal diseases fall into this category.

H-10 also uses dead-reckoning as a means of navigation; there has been a report that, at one time, they were observed dumping at a location that was not the designated site.

2.5.2 Alternatives

a. Alternatives common to both disposal operations are:

(1) Land Disposal Alternative - Approved sites for the disposal of solid and liquid waste are available for a majority of the California Salvage Company operations; some of the more reactive chemicals may not be acceptable. Garbage from U.S. Navy vessels is now cooked and disposed of at an approved site.(2)(4) This could be done for the H-10 Water Taxi Company garbage. This amounts to a no-dumping alternative.

(2) Sorted Material Disposal - In conjunction with land disposal of some materials, the sorting of materials unacceptable for land disposal, and disposing of only those at sea, is another alternative. California Salvage could sort for dumping at sea those highly reactive and toxic

components that are not suitable for a land disposal situation. H-10 could sort to dump only materials considered dangerous to animal health. This would allow land disposal of most trash material.

b. Because of the different materials several alternatives are not similar and apply only to one or the other of the operators; these are:

(1) Containerization Alternative - The existing dumping operation by California Salvage uses little containerization except for the convenience of transporting materials. This alternative, if applied to all wastes, with containers that are weighted sufficiently to be negatively buoyant, would reduce the possibility of harm to trophic zone marine life. Even if the containers rupture under hydrostatic pressure, leakage would most likely be slow enough to dilute the materials sufficiently by natural current flows. The operation by H-10 would not be benefited by this alternative.

(2) Pulverization Alternative - H-10 Water Taxi dumping operations could be improved by reducing the garbage and trash to a sludge by shredding or grinding, so that the materials are pumpable. This would allow the distribution of the materials below the surface in a less concentrated form. This dispersion of material can be beneficial as decomposition will be accelerated.

2.5.3 Recommendations

Even though the Southern California area is the home of a major oceanographic laboratory, and has many institutions engaged in ocean research, the existing disposal sites have not been examined in any definitive study. Several recommendations for compiling site information for regular site study are recommended in the following two paragraphs of this section. These are followed by recommendations and requirements necessary if the dumping of wastes is to continue.

Initial Site Study

All available information on these sites should be obtained and compiled in order to describe the dump site area more comprehensively. Additional survey work should be scheduled to fill gaps in the information and to provide details of information that is not complete. A study should be initiated to

better define the composition and concentration of the dumped materials.

Regular Site Study

A program of regular cruises should be established to study the effects of the dumping. The program should include data gathering studies before, during, and after several dumping operations, and annual or more frequent cruises to study possible incremental changes in the site biosphere.

Restrictions on Use

With information collected in initial site studies and surveys, an operating schedule should be developed so that dumping occurs at times considered to be least harmful to marine life. This may entail some additional storage capacity on the part of the operators. Also, a better idea of the composition of the dumped materials would allow restriction on amounts allowable for dumping at any one time if this were necessary.

Requirements for Use

California Salvage Company and H-10 Water Taxi Service have similar operations (manual handling) procedures, but the composition of their wastes differs. Possible requirements are presented separately because of the waste differences.

California Salvage Company

A greater effort must be made to separate those materials acceptable for other means of disposal from those requiring at-sea disposal. Only those unacceptable for alternative methods of disposal should be dumped in the ocean. For those materials to be dumped, a packaging method, such as weighted drums, should be specified to allow sinking of the materials to the bottom in as short a time as possible. Also, personnel handling the materials should be aware of the dangers in handling and mixing chemicals.

H-10 Water Taxi Service

A method for disposal of the garbage should be specified so that all materials to be disposed of at sea are reduced to pulp by grinding or maceration. Floatable materials and materials not organic in nature should be sorted out and disposed of by other means. Both operators should be required to acquire and maintain adequate navigation equipment to position the vessels positively at the dump site. A short-range radar set would be adequate, because neither site is very far from the coast or an island. Also, both operators should submit periodic reports on their discharges to EPA and should specify materials, amounts, method of disposal, date and time of disposal, and total amounts of materials for each discharge period.

Section 3

OCEAN WASTE DISPOSAL PRACTICES IN THE SAN FRANCISCO AREA

3.1 INTRODUCTION

Oceanic areas affected by marine-transported wastes from the San Francisco Bay area are the subject of this section.

The San Francisco area is located in Central Northern California and is the only major port in the northern part of the state. San Francisco has a history of ocean dumping that has in recent years been under close scrutiny by local and state regulatory agencies. As a result of the local activities, most ocean dumping has stopped, either by direct regulation or because of monetary pressures and environmental concern expressed by the regulatory agencies. Figure 3-1 (a portion of National Ocean Survey Chart No. 5021) shows locations of existing and past dump sites in the study area.

Although the area inside the Golden Gate was not originally intended to be a part of this report, some information is provided on dumping of dredge spoils inside the Bay.

SAN FRANCISCO

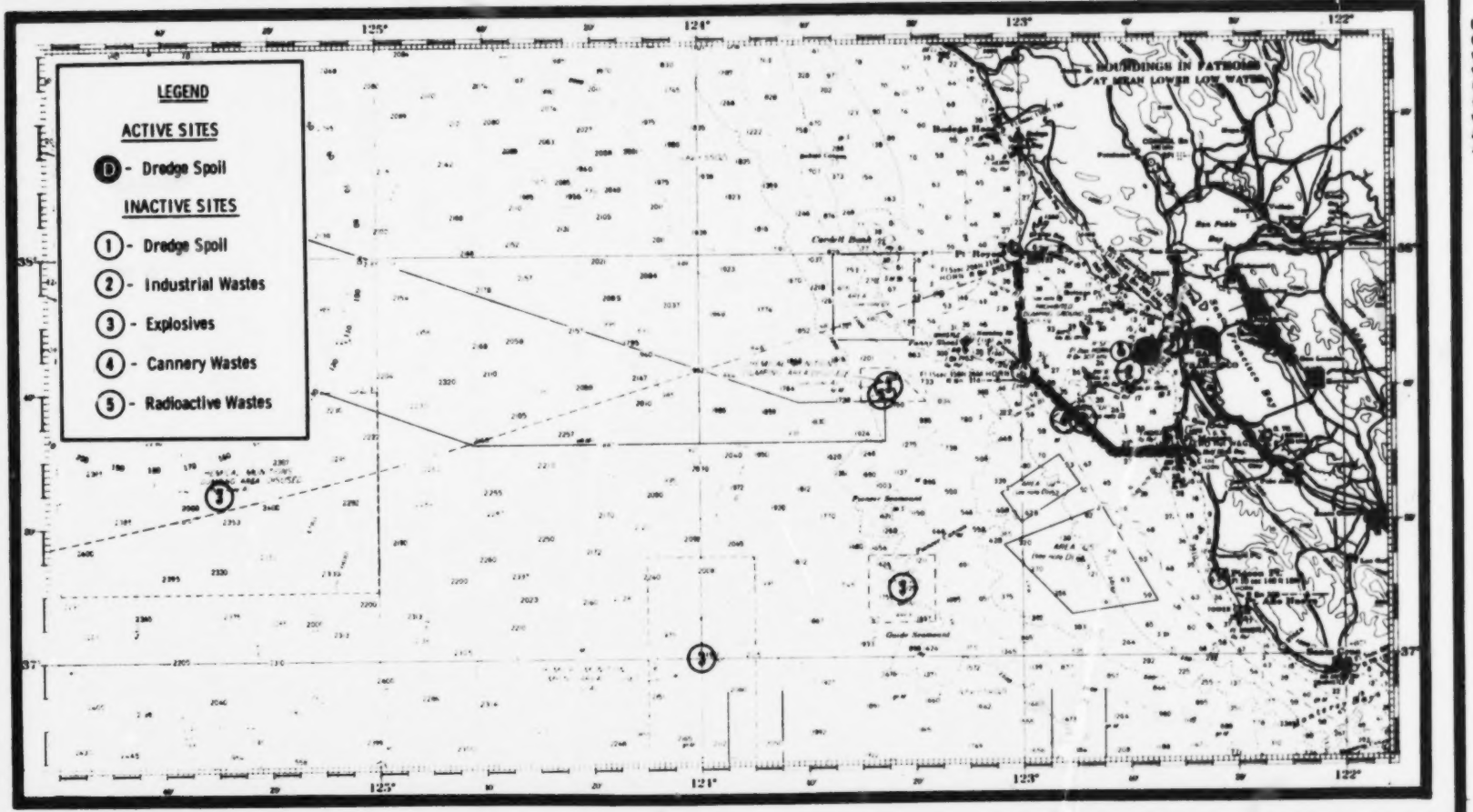

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FIGURE 3-1

LOCATIONS OF PAST AND EXISTING OCEAN DUMPING SITES SAN FRANCISCO AREA

IEC INTERSTATE ELECTRONICS CORPORATION

Dumping of materials at sea in the San Francisco area is at present limited to the disposal of dredge spoil materials. These materials are generally those that are deemed polluted and, thus, not suitable for disposal within the Bay itself, except for the material removed from the main ship channel on an annual basis and deposited just south of the channel. One dumping activity that had been active in the past few years, a cannery waste disposal, has been terminated recently. This was the only remaining operation, other than dredge spoil disposal, that entailed ocean disposal.

3.2 HISTORY OF DUMPING IN THE SAN FRANCISCO AREA

Dumping of wastes in the study area offshore of the Golden Gate have been in six categories of materials: (1) refinery wastes, (2) acid wastes, (3) cannery wastes, (4) radioactive wastes, (5) munitions, and (6) dredge spoil.

A summary of the wastes disposed of between 1931 and 1972 is presented in Table 3-1.

3.2.1 Refinery Wastes

The estimate of 315 million gallons of refinery wastes is from one of two known generators of this waste.

TABLE 3-1

SUMMARY OF WASTES DUMPED INTO THE OCEAN AREAS OFFSHORE OF SAN FRANCISCO

TYPE OF WASTE	PERIOD	1931-72 ESTIMATED TOTAL	PRESENT ESTIMATED TOTAL
Refinery Wastes	1966-72	315 M Gal	--
Acid Wastes	1948-71	240 M Gal	--
Cannery Wastes	1960-72	246 K tons	--
Radioactive Wastes	1946-68	44,563 containers	--
Munitions	1968-69	746 tons	--
Dredge Spoil	1935-72	---	1 M yards

Standard Oil Company of California, beginning in 1966, discharged about 45 million gallons of chemical wastes per year from their Richmond refinery. The location of the dump site was stated as "at least 5 miles offshore." Standard Oil agreed to terminate their operation no later than December 31, 1972. During the period between December 22, 1970, and December 31, 1972, they were required to dump at least 3 miles beyond the Gulf of the Farallones.[14] Standard Oil has developed a method to treat their wastes and has been able to terminate the ocean disposal of this material.

Shell Oil Company discharged wastes from its Martinez refinery at a location 50 to 100 miles from shore.[15] Information on

disposal frequency, and annual amounts on this discharge, were not available. This operation was ordered terminated by December 31, 1971, by the Regional Water Quality Control Board. The composition of these wastes has not been determined.

3.2.2 Acid Waste

United States Steel Corporation discharged about 10 million gallons per year of spent steel pickling acid into the ocean about 14 miles southwest from the Golden Gate and about 9 miles offshore[14] (at approximately 37°72'N, 122°40'W in about 120 feet of water). This operation began in 1948 and was terminated April 30, 1971. U.S. Steel has found a commercial outlet for its hydrochloric acid and disposes of its sulfuric acid in a sanitary landfill.

3.2.3 Cannery Wastes

Beginning in 1960, the Oakland Scavenger Company was contracted by six East Bay fruit and vegetable canneries to dispose of their wastes. The volume of the discharge was about 22,000 tons per year. The disposal site was in water depth of about 260 feet, at a location approximately 20 miles offshore of San Francisco. The latitude and longitude has been determined to be 34°35'N, 122°50'W. Recent contact with Oakland Scavenger has determined that the operation has been terminated because of increasing costs associated with the monitoring requirements. An

alternative method of disposal has been determined to be more cost effective when environmental concern was taken into account.

3.2.4 Radioactive Wastes

Licensees regulated by the U.S. Atomic Energy Commission dumped, in the period 1946 to 1968, about 44,563 containers of radioactive wastes into the ocean about 16 miles southwest of the Farallon Islands.(14) This location would be approximately centered at 37°31'N, 123°14'W. This site location was not mentioned in previous dump site reports.(16) Dumping was terminated by changes in Federal policies in the late 1960's. Positive determination as to what is called a container is not possible, although the normal disposal method is to encase an amount of the waste in concrete within a 55-gallon drum. The actual amount of waste per barrel can vary from a few grams to a few pounds, depending on the storage capability of the licensee.

3.2.5 Munitions

During 1968 and 1969 the U.S. Navy disposed of some 510 tons of conventional munitions in a designated disposal site some 18 miles west of the Farallon Islands. The disposal site is a trapezoid with an approximate center at 37°40'N, 123°25'W, and averaging 6600 feet in depth. In addition, a ship (the SS John F. Shafroth) was sunk on this site in 1964 under the "Chase" disposal operation. It contained approximately 236 tons of waste

ammunition and explosives.[17] These methods of disposal have been discontinued. The Navy is constructing an ammunition defusing facility in the Bay area and will recycle some out-of-date ammunition.

3.2.6 Dredge Spoil

The U.S. Army Corps of Engineers discharges materials from maintenance and improvement activities both near the main channel entrance and within San Francisco Bay. Also, activities under Corps of Engineer permits have discharged materials outside the Bay. Main channel entrance maintenance programs have placed about 600,000 cubic yards annually in a location just south of the channel. This amount is expected to nearly double, with planned deepening to 55 feet of the entrance channel in the near future. Also planned is the disposal of about 900,000 cubic yards of material that exceeds heavy metals criteria, offshore of the 100 fathom isobath some 30 miles out from the Golden Gate and 8 miles south of the Farallon Islands.[18] (This material is from a project in the Oakland Inner Harbor.) The Corps of Engineers and permittees to the Corps are the major users of ocean dumping areas in the San Francisco area at present. Approved dumping areas for use inside San Francisco Bay are now limited to five specific sites; these are described in a San Francisco Corps of Engineers District Public Notice[19] and are

in concurrence with a San Francisco Regional Water Quality Control Board Resolution.(20)

The Bay Area Rapid Transit District disposed of dredged materials at a site just outside the Golden Gate during the late 1960's. This site is centered at 37°46'36"N, 122°32'33"W. It is not known if this site had been used prior to that time, nor are volumes of this project known.

3.3 SUMMARY

Because of recent events, ocean disposal in the San Francisco area is presently limited to the disposal of materials derived from dredging the main channel at the entrance to San Francisco Bay, and to the disposal of materials considered undesirable to dump in the bay proper.

Except for temporary turbidity and possible burial of some bottom dwellers, the main channel project probably does not cause any serious problems in the local dump site biota and it allows the retention of possible beach replenishment materials within the local littoral regime.(21)

The disposal of unwanted materials from within the bay is another matter. The materials could contain concentrations of heavy metals above present criteria and chlorinated hydrocarbons above

present standards, and could be toxic because of high oxygen demanding constituents. Although at present, no alternatives are known for all cases, a thorough study for some alternative to each projected use of the ocean should be undertaken on a case-by-case basis.

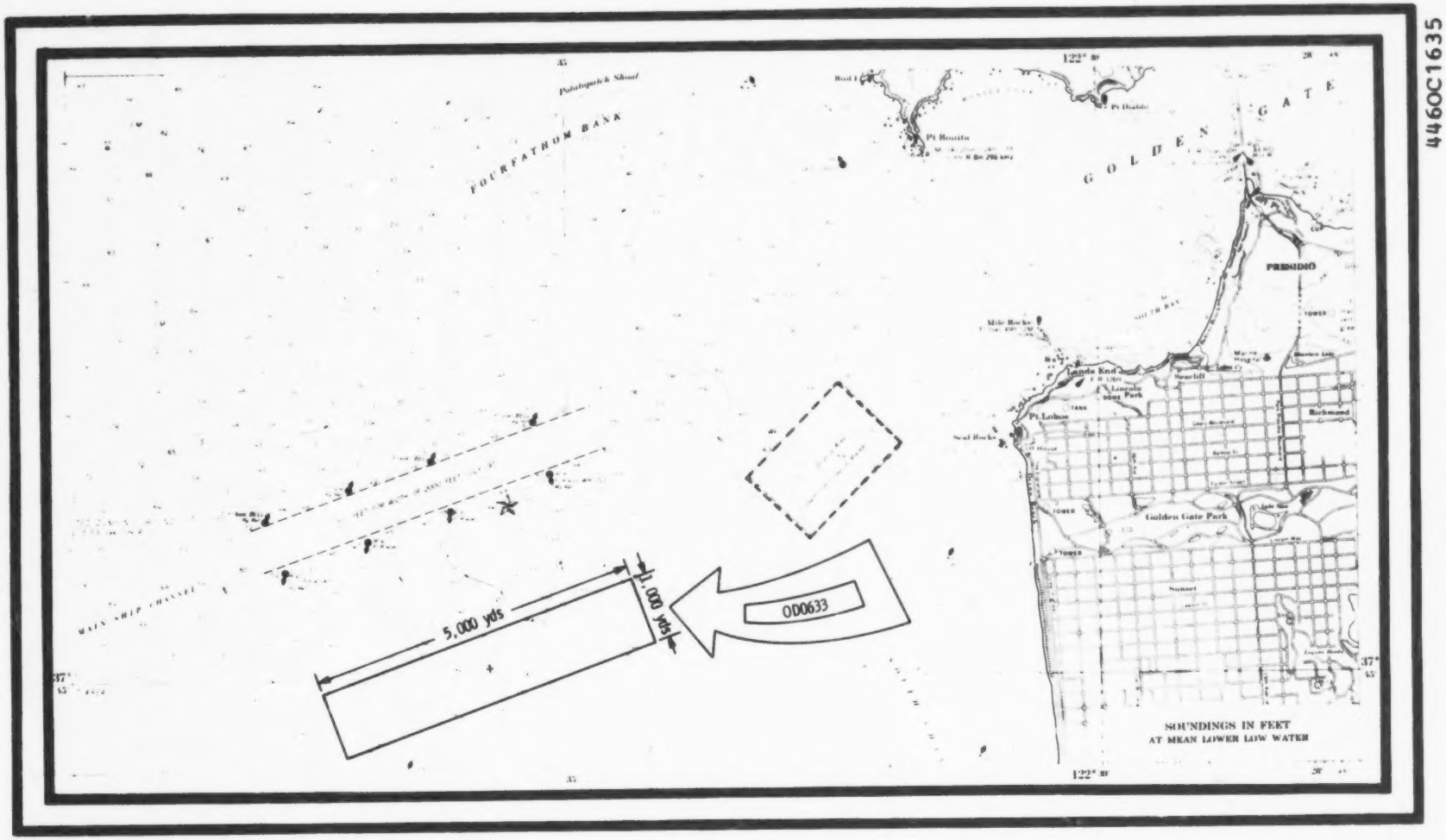
3.4 PRESENT DUMPING ACTIVITIES IN THE SAN FRANCISCO AREA

Dumping activity in the study area is, at present, limited to two dredge spoil activities, both under U.S. Army Corps of Engineers administration. One site is used for the disposal of material from the main ship channel into San Francisco Bay. The other site (not yet determined positionally) is for the disposal of contaminated material from future projects within the Bay. Also, a site used, until recently, for disposal of cannery wastes will be discussed as it is an example of this type of operation, and because an extensive study of the effects of the materials upon the biota has been made, which should receive recognition.

3.4.1 Site No. OD0633

This site is the location where dredge spoil obtained from the maintenance of the entrance channel to San Francisco Bay is deposited. On an annual basis, the U.S. Army Corps of Engineers deposits approximately 600,000 cubic yards of spoil in the dump area outlined in Figure 3-2.

SAN FRANCISCO



4460C1635

INTERIM DISPOSAL SITE

September 1973

Center Coordinates	37° 45' 06" N, 122° 35' 45" W
Area	1.2 Square Nautical Miles
Navigation Chart No.	NOS 5532
Local Navigation Aids	Loran A, Omega, RDF, Radar, VTR
Material Type	Dredge Spoil
Primary Management	COE

FIGURE 3-2

SITE NO. OD0633

INTERSTATE ELECTRONICS CORPORATION

Site Description

The site is on a submerged sand bar (San Francisco Bar) which extends in an arc outside the Golden Gate at a distance of about five miles. It is 3000 feet south of the main ship channel and runs the length of the dredged portion, or about 5000 yards at the present project depth of 50 feet and is 1000 yards wide. Water depth in the disposal site ranges from 50 feet at the ends of the site to less than 36 feet near the center of the site. If the new 55-foot project depth is used, the disposal site would increase to 3 1/2 miles in length and an annual maintenance quantity of 900,000 yards is projected. The center of the disposal area is at 37°45'06"N, 122°35'45"W.

The shape and position of the bar is maintained by a dynamic balance between tidal flows, prevailing wave actions, and coastal currents. The materials of the bar are 90 to 95 percent fine sands, with the remaining materials falling into the ranges of silts and clays. It is believed that this material is predominantly derived from erosion of north coastal cliffs and outwash of streams. It is transported to the bar by longshore coastal currents. No measurable part of the material on the bar is believed derived from the bay system itself. Apparently, the outflow of fines from the bay system by tidal flows is carried out over the bar into deep water. The result is submerged beach, maintained by longshore sand transport, and held offshore by the

repulsion of an ebb tidal prism. The central bar has approximated its position and depth since 1855, when a study recorded its position and shape. This position has varied less than 1500 feet and the depth by less than 10 feet over the central portion of the bar, exclusive of dredged areas since that date.(21)

In the past, materials from the main ship channel were deposited in deep water about one mile southwest of the seaward channel entrance. After a comparative assessment of the use of the deep site, land disposal, or deposition on the bar itself, the Corps of Engineers has determined that redeposition is the best alternative, hence the use of the present site.

Chemical Oceanography

On April 5 and June 8, 10, 18, and 30 of 1971, water samples were collected. The April 5, June 8, and June 30 dates were predredging and postdredging backgrounds; the remaining dates are days of dredging activity.

In 1971, the Corps of Engineers collected samples of water from the main ship channel and the disposal site. They obtained information on temperaure and depth with a bathythermograph and surface temperature with a laboratory standard thermometer. Salinities were determined from samples by an induction

salinometer. Densities were computed by the Corps of Engineers.[21] Data is presented in Table 3-2.

TABLE 3-2

WATER COLUMN DATA - 1971
MAIN SHIP CHANNEL AND DUMP SITE

DATE TIME	DEPTH (ft)	SALINITY (°/oo)	TEMP (°C)	DENSITY	DISSOLVED OXYGEN (ppm)	Ph	TURBIDITY (JTU)
05 APR 71	20		11.2		7.1	7.3	<5
08 JUN 71							
0600	0	33.49	10.2	25.76			
	18	33.51	9.7	25.87			
	36	33.80	9.5	26.12			
1300	0	33.49	10.5	25.71			
	18	33.56	10.1	25.85			
	36	33.77	9.7	26.18			
1700	0	33.58	10.6	25.77			
	18	33.46	10.6	25.66			
	36	33.64	10.2	25.88			
2300	0	33.63	9.9	25.93			
	18	33.81	9.4	26.15			
	36	33.84	9.4	26.16			
10 JUN 71							
1227	10				7.7		
18 JUN 71							
0801	10				8.7	7.7	
1015	10				6.3	7.7	
1129	10				6.5		
1240	45				8.8	7.7	
30 JUN 71	20		10.5		7.5	7.5	<5

Notes:
On 10 June, release time (start of release) of dredge spoil from the hopper dredge BIDDLE was 1227. On June 18 release times were 0736, 1047 and 1230.

Climatology

Due to the influence of the ocean and the generally westerly winds, the coastal area of San Francisco has a climate that is mild in comparison to cities at similar latitudes. Temperature variations are small, both between day and night and from month to month. Day to night temperatures vary by about 5°C and the largest month to month variation is about 2.8°C (November to December). Although noted for fogs and overcast skys, San Francisco experiences about 63 percent of the possible sunshine over a year. As a comparison, Washington, D. C. in 1910 received 59 percent possible sunshine and San Francisco received 66 percent possible sunshine. The area offshore has a lower figure because fogs do not penetrate into the city as soon as they cover the offshore area. Winds are predominately from the west. Winter southerly gales are not infrequent. During May and June, gales of remarkable velocity from the northwest are almost annual events.(22) The highest winds recorded were north-northwest winds which occur in November, December, and January. The average hourly wind velocity at San Francisco is nearly 10 miles per hour, with highest velocity in late afternoon (4-5 p.m.), and least velocity about 6 a.m.

One of the most marked climatic features of San Francisco is the presence of fog. During summer afternoons, fog moves through the Golden Gate about 1 p.m. and covers the sky by 3 p.m. and

remains until 9-10 a.m. During May and September, fog that appears later (usually near dusk) also stays until 9 a.m. Winter or tule fogs, formed inland from the Golden Gate, are also frequent to the bay area. It is interesting to note that a paper[22] on weather in San Francisco dated 1913 makes reference to smoke fogs (now called smog) that are a part of the bay area climatology. Table 3-3 has been assembled from various publications [22][23][24], and summarizes some climatological conditions of the San Francisco area. All parameters are from data taken in San Francisco City, except for precipitation amounts which are for the Farallon Islands (considered more representative of the dump site).

TABLE 3-3

SAN FRANCISCO CLIMATOLOGY

	AIR TEMP (°C)	PRECIP-ITATION (Inches)	WIND SPEED (MPH)	WIND DIREC-TION	PERCENT SUNSHINE (%)
January	9.6	4.90	7.2	S	50
February	10.7	3.55	7.6	W	63
March	11.1	3.36	9.1	W	67
April	12.1	1.64	10.3	W	66
May	13.1	0.73	11.5	W	67
June	13.5	0.16	12.9	W	75
July	13.6	0.02	13.4	W	68
August	13.9	0.02	12.5	W	61
September	15.0	0.32	10.3	W	68
October	14.7	1.00	8.0	W	68
November	12.9	2.55	6.8	W	58
December	10.1	4.51	6.7	NW	54
Annual	12.6	22.60	9.7	W	63

Biology

Biological information at the disposal site is of a limited nature; however, the U.S. Army Corps of Engineers District Office in San Francisco has conducted biological studies at the disposal site and is presently involved in studying the marine biota, with emphasis placed upon the benthic organisms. A benthic faunal study currently underway is expected to be completed and results available shortly. This benthic study is part of a planned study program to determine the potential smothering effects on bottom organisms by the accumulation of dredge material at the disposal site, and the time interval necessary for repopulation of bottom organisms in the dredged area. In addition to this research, the Corps of Engineers also expects (during fiscal year 1974) to study the plankton organisms at the disposal site. A brief literature search has revealed no fish faunal lists at the site. A list of fishes found in San Francisco Bay along with the benthic invertebrate fauna is available in a California Fish and Game publication.[25]

Benthic life at the disposal site, as identified by collected samples and diver observations, appears to be of the burrowing types, and they are apparently capable of withstanding some sediment accumulation without permanent harmful effects.[21] These organisms include mollusks (snails, clams), polycheate

annelid worms, sand dollars, and various crustaceans such as crabs, shrimp, and isopods.

TABLE 3-4

IDENTIFICATION OF BOTTOM ORGANISMS AT DREDGE SPOIL SITE

PHYLUM CLASS Order *Genus species*	COMMON NAME
ANNELIDA POLYCHAETA	Marine worms
ARTHROPODA MALACOSTRACA Amphipoda *Cancer magister*	Market crab
Betaeus harfordi	Shrimp
Isopoda *Janiralata davisi*	Isopod
MOLLUSCA GASTROPODA Pectinibranchia *Olivella pycna*	Olive shell
Olivella baetica	Olive shell
Nassarius fossata	Whelk snail
ECHINODERMATA ECHINOIDEA Clypeastroida *Dendraster excentricus*	Sand dollar

Table 3-4 lists a few of the organisms that have been found at the disposal site. More diversified fauna exists; however, the information is not available for publication.

A list giving the plankton organisms could not be obtained; however, the usual components of the plankton, (i.e., Phytoplankton, protozoans, copepods, cladocerans, Scyphozoa (jellyfish), amphipods, mysids, isopods, chaetognaths (arrow worms), fish eggs, and various larval stages of fish, crustaceans, and mollusks are present.

Users of the Site

The only user of this site is the Army Corps of Engineers, San Francisco District. They deposit materials dredged from the main ship channel annual maintenance program. Maintenance of the 50-foot project depth achieved in 1959 has required removal of approximately 580,000 cubic yards annually from the channel. The new project depth of 55 feet will increase the annual maintenance amount to about 940,000 cubic yards. During the period required to achieve the 5-foot increase in depth (about four years) a projected annual dredging volume of 1.1 million cubic yards will be removed from the channel and deposited at the disposal site. This project started in 1971 and should be achieved in 1974.

Authority for the work performed on the main ship channel comes from the River and Harbor Act of 1965, which gives the Corps of Engineers authorization to complete the John F. Baldwin and Stockton Ship Channels. This project included the deepening of

the main ship channel and various other work within the bay and San Joaquin River navigation system.

The composition of the dredged materials was the subject of a study performed by the U.S. Army Corps of Engineers, San Francisco District, during the period from December 1970 to June 1971.[21] Three sets of samples were collected; the first and third sets of samples were collected on the hopper dredge Biddle while it was dredging the channel on December 28, 1970 and June 8, 1971, respectively; the second set (3 locations) was collected by bottom dredge and sample bottle on April 5, 1971 from a survey boat. A summary of the results of these samplings is presented in Table 3-5.

In addition to the analyses shown in Table 3-5, other tests were performed on some samples. On the samples collected April 5, 1971, tests for pesticides were run and, with a composite of samples, a 96-hour static bioassay was performed on three spined stickleback fish, both by the EPA Regional laboratory in Alameda. The results of the bioassay were inconclusive because of the high survival rate of the test fish. The pesticide tests (maximum concentration achieved from 3 samples) are shown in Table 3-6.

TABLE 3-5

SUMMARY OF SEDIMENT ANALYSIS
MAIN SHIP CHANNEL
U.S. ARMY CORPS OF ENGINEERS, SAN FRANCISCO

Parameter	Concentrations in Parts/Million by Weight				
	28 Dec 70	5 Apr 71			8 June 71
	Sample	Sample 1	Sample 2	Sample 3	Sample
COD	174	6,800	26,000	5,000	1,650
Oil-grease	356	1,000	1,000	1,000	NA
Kieldahl-N(T)	13	220	620	120	170
TVS	NA	21,000	39,000	14,000	11,900
Lead	4.79	14.20	27.20	12.20	13.00
Mercury	0.08	0.02	0.03	0.01	0.03
Zinc	37.81	48.60	79.90	34.50	55.00
Arsenic	0.01				
Chromium	1.99				
Cadmium	2.08				
Copper	1.67				
Nickel	37.81				
Phosphate(T)	32.90				
Sulfides(T)	0.28				

TABLE 3-6

PESTICIDE CONCENTRATIONS (MAXIMUM 3 SAMPLES)
SAN FRANCISCO MAIN SHIP CHANNEL
5 April 73

Pesticide	Concentration (ppb)
OP' DDE	1.64
PP' DDE	1.64
PP' DDD	1.34
OP' DDT	0.54
PP' DDT	3.74
Arochlor 1254	19.60

Operational Description

Removal of material from the bar and deposition at the site is performed by an Army Corps of Engineers hopper dredge (Biddle). A side hopper dredge of some 352 feet overall length with a beam measurement of 60 feet, the Biddle has an average capacity of 3060 cubic yards. One cycle on the main channel averages 110 minutes. Loading time is about 65 minutes, unloading about 15 minutes, and 30 minutes transit time to and from the site. Speed during disposal is about five knots. Material is released from valves which, when fully open, are 42 inches below the bottom of the vessel.

Site Managers

Primary administrative responsibility for the management of this site lies with the U.S. Army Corps of Engineers, San Francisco District. In addition, the site is at least partially within the California Water Quality Control Board, San Francisco Region area of administration.

The Army Corps of Engineers has met all requirements set forth by the State Board, even though not required to do so. They have conducted studies on the effects of the dredging and maintain a line of communication with all Federal and state agencies with an interest in their work. Monitoring, of a continuous nature, is neither performed nor required. Some sampling has been done on

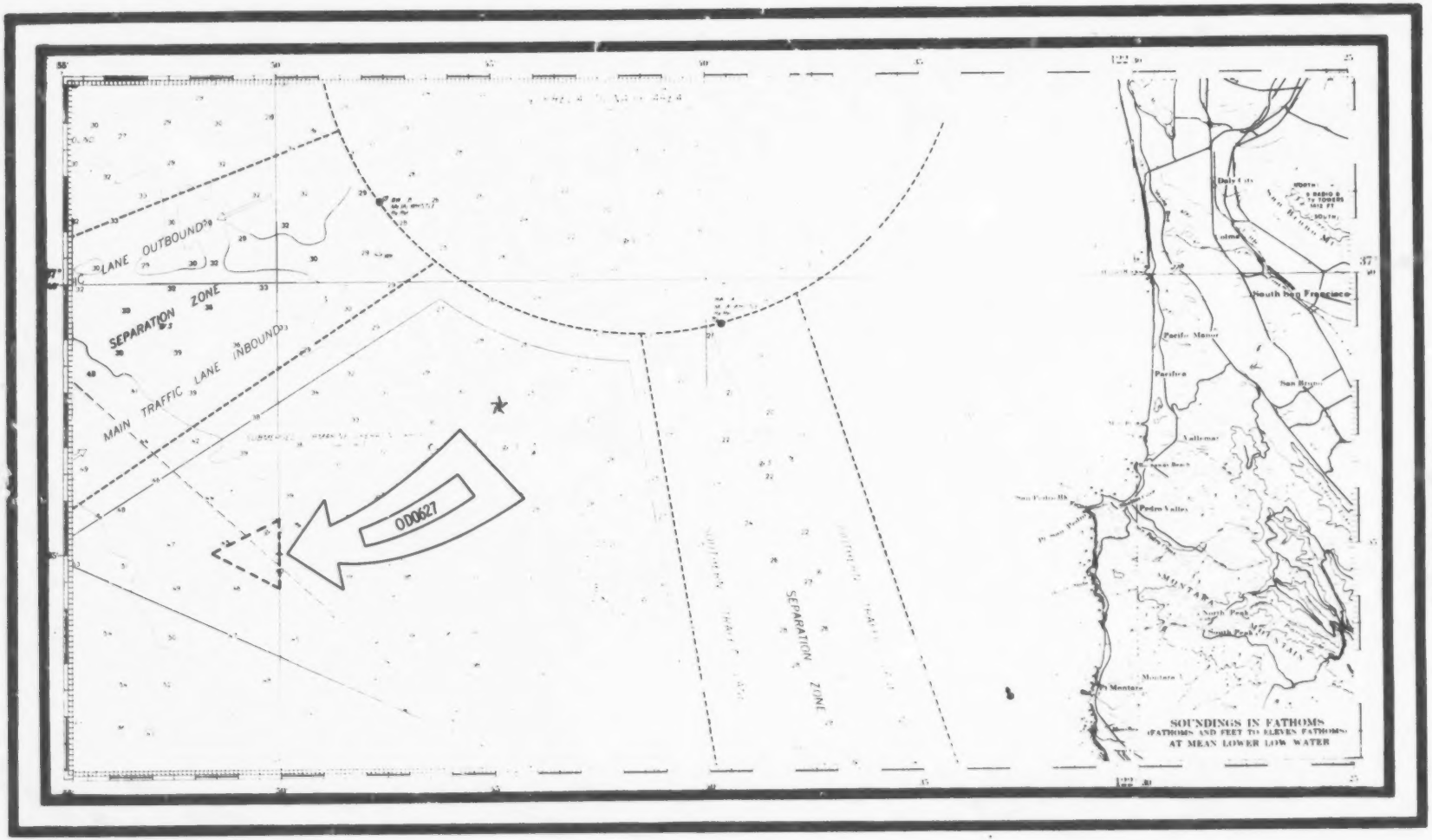
an irregular basis outside the bay, and a recent program has started to determine the effects of dredge disposal within the bay. Samples of the dredge spoil are collected on an irregular basis during operations.

3.4.2 Site No. OD0627

Approximately 11 miles southeast of the Farallon Islands and 16 miles west of the mainland shore is the location where, until recently, cannery wastes were discharged. A map showing this location is presented as Figure 3-3

Site Description

An area defined only as centered at 37°35'N, 122°50'W with no shape or dimensions. It is located just shoreward of the 50-fathom isobath at a depth of 254 feet. It is outside the Gulf of the Farallones and near the top of a slope that outlines the coastal plain of the San Francisco area. The ocean bottom at the disposal site ranges from mud to fine, hardpacked sand. Currents in the area are generally associated with the California Current and Countercurrent, and are not as large as found inshore near the Golden Gate. A marked midsummer upwelling and winter downwelling associated with southwest winds exist at the site. Surface water temperatures normally can vary 9°C during the year.



SAN FRANCISCO

INTERIM DISPOSAL SITE

September 1973

Center Coordinates	37° 35' 00" N, 122° 50' 00" W
Area	Undefined
Navigation Chart No.	NOS 5072
Local Navigation Aids	Loran A, Omega, RDF, Radar, VTR
Material Type	Cannery Waste
Primary Management	EPA

FIGURE 3-3

SITE NO. OD0627

INTERSTATE ELECTRONICS CORPORATION

Salinity increases with depth, with surface salinities of about 33 parts per thousand. Salinity variations are marked and coincide with upwelling periods.(17)

Users of the Site

Oakland Scavenger Company of Oakland was contracted by six East Bay food processing plants to dispose of canning wastes at sea. The Ocean Disposal Program started in 1960 and terminated in 1972 because of pressures from outside stimuli. The dumping operation entailed disposing of about 22,000 tons of waste per year during the months between July and October.(14)(26) The disposal vessel has a single-load capacity of 1040 tons of, which 20 to 25 percent is water used to improve waste pumping quality.(26) This left a single load with 780 tons of waste, for which 30 trips during the 4-month period would be required. This would be about one every four days. Actually, the disposal frequency was predicated upon the accumulation of the waste at the land holding site, and it is expected the frequency would gradually peak then taper off near the end as the canning season does.

The dumped materials consist of solid residuals produced from canning of fruits and vegetables. Approximately 90 percent of the wastes are peach and pear residuals. Of the peach residuals, 90 percent is obtained from overripe and underripe fruit, culls or undersize fruit, and normal peaches diverted from production.

The pear residues are composed mainly of peel, core, stem, and blossom end cuts. This accounts for about 80 percent of the residue. The rest consists of rejected fruits considered unfit for canning.

The National Canners Association Research Foundation Berkeley, has run analyses of peach and pear wastes and obtained the results shown in Table 3-7. (Maximum and minimum values are shown for a set of four samples.)

Operational Description

The method used for disposal of the wastes is the reduction of solids to a consistency that is pumpable when mixed with water and loading on a barge which, after arrival at the site, pumps the material into the sea. The barge is nonpropelled, has a length of 165 feet, is 40 feet wide and draws 9 feet of water, fully loaded. The cargo is contained in four separate compartments, each having its own discharge pump. Speed maintained during disposal is 3 knots. The waste outlets are pipes that extend some five feet below the vessel bottom when the barge is empty. As stated before, an initial onshore dilution of about 25 percent is achieved by adding water to make the residue pumpable. When discharging, a pump further dilutes the discharged materials by an additional 25 percent. The actual

waste discharge is approximately 56 percent of the initial total percent waste residue concentration.

TABLE 3-7

NATIONAL CANNERS ASSOCIATION
PHYSICAL AND CHEMICAL CHARACTERISTICS
OF FOOD PROCESSING RESIDUALS

PARAMETER	MINIMUM	MAXIMUM
pH	3.6	3.7
Suspended solids, ppm	29,000	35,400
Volatile suspended solids, ppm	15,200	18,600
Settleable solids, ml/l	56	61
Total solids, ppm	176,800	181,800
Chemical oxygen demand, ppm	192,000	207,900
Total oxygen demand, ppm		
settled	143,200	152,000
mixed	199,100	213,200
Biochemical oxygen demand, ppm		
15-minute	310	400
6-hour	3,900	4,400
5-day	82,000	88,000
20-day	118,000	128,000
protein, %	0.61	0.814
carbohydrate, %	7.60	8.50
crude fibre, %	7.60	8.50
fat, %	0.16	2.30
chlorinated hydrocarbons, ppm	0.010	0.02
organophosphates	0.015	0.03
cadmium, ppm	0.04	0.08
chromium, ppm	0.02	0.02
copper, ppm	0.01	0.04
lead, ppm	0.08	0.10
mercury, ppm	0.006	0.009
zinc, ppm	0.06	0.13

Site Managers

During the period this operation was active (1960 to 1972), administrative responsibility over the operation was with the California Water Quality Control Board, San Francisco Region. Although not truly within its jurisdiction (the discharge point was outside the territorial waters of the State of California) the board, by virtue of its desire to protect California waters, asked the dumpers to comply with some restrictions. The dumpers agreed to the board recommendations and, under a board resolution[14], were compelled to conduct a study to demonstrate that the discharge did not have adverse effects on water quality. Also, when under Regional Board discharge requirements, a discharger had to make periodic reports of the discharge to meet self-monitoring requirements of the California State Water Code. Oakland Scavenger and National Canners Association met all requirements prior to terminating their operation in 1972.

3.5 ANALYSIS OF SAN FRANCISCO AREA DUMPING OPERATIONS

The maintenance of the main ship channel which is the only on-going ocean disposal operation in the San Francisco area is the subject of this section.

3.5.1 Problems

Problems associated with the disposal of dredge materials from the main ship channel at San Francisco Bay are:

a. Direct burial of bottom-dwelling marine life.

b. Toxic materials in the sediments.

c. Increased turbidity inherent in disposal of dredge spoil.

d. Depression of dissolved oxygen by oxygen demanding chemical and biological materials.

e. Increases in productivity above normal levels because of nutrients released from the sediments.

Direct burial of marine organisms is a factor that was studied at the main ship channel disposal site. The study determined that the present community could survive, to a great extent, the addition of materials that were found attributable to the disposal operation. A diving survey conducted at the time of dredging determined no noticable addition to the bar by the disposal runs. A layer, in fluid state, exists under most normal sea conditions and seems to absorb the new material quite readily. The natural erosion and deposition is believed to exceed the capacity of present dredging equipment, even under sustained operations.(21)

Toxic materials, primarily heavy metals, are present in the main ship channel sediments.(21) The only material which exceeds present criteria is zinc, which in two samples was 10 percent and 60 percent above the criteria. Although not exceeding the criteria, lead was fairly high in one sample. These high zinc and lead counts may reflect a naturally high content of the sediments. There is some evidence that zinc ions are strongly absorbed in a permanent manner in silt, with resultant inactivation of the zinc. Lead is at its minimum toxic capability in seawater as compared with fresh water. A concentration of 70 x 10-4 parts lead in soft tapwater was not toxic to minnows and stickleback fish over a three-week test period.(13)

Increased turbidity is an expected problem associated with any method of disposing of dredge spoil. The toxic effects of increased turbidity have been the subject of many studies, the results of which have not shown great problems except with very high levels of turbidity not expected on this disposal operation.

Depression of the oxygen available for supporting life is a problem when dredge spoil is contained in a small area for long time periods. When spoil is allowed to disperse over a large area this depression rarely exceeds levels that would be dangerous to marine life and is short term in its effects.

Nutrient release causes rapid population surges in algae communities. The nutrients in the sediments of the main ship channel are not too high to cause large blooms, although at times of low currents and calm weather blooms could occur. Blooms caused by artificial nutrient inputs can cause immediate and drastic depressions of oxygen levels that can be fatal to active types of fish.

3.5.2 Alternatives

Several alternatives are available to the dredging of San Francisco Bar. They are:

No Dredging Alternative - If the San Francisco bar main ship channel were allowed to return to its natural state, the effect upon the San Francisco Bay area would be an economic disaster. Ships now trading the world's ocean would not be able to enter the bay because of the decreased water depths to be expected at the bar.

Land Disposal Alternative - Material could be deposited on land, but the benefit gained would be doubtful. Unless it was deposited on the beach, the sand would be lost from the littoral regime and erosion of beaches would be accelerated.

Disposal in Deep Water - This method would have all the problems of the present method, plus the sediment would be lost to the littoral regime.

Under present conditions the best available method for disposal of these materials is the existing method. Until more is learned concerning the problem areas, it is considered to be the rational approach to disposal of this material.

3.5.3 Recommendations

Four areas of improvement are considered necessary to provide effective management of the dredging project of the main ship channel.

a. In order to completely assess the impact of the dredging, a study of the dredged channel and disposal site should be initiated. The study should be of a long-term nature to define seasonal variations as well as temporal variations in the two areas.

b. Monitoring of the disposal operation should be a mandatory requirement. The possibility of lenses of toxic materials that should be deposited elsewhere could be detected, and suitable action taken.

c. At times during the year, the possibility of damage to the biota is greater than at other times. Crab larvae are planktonic during January to June; therefore, the dredging should be scheduled before or after this period.

d. Information derived by the site user should go to EPA in a timely fashion. Channels should be established so that all phases of work are known in advance, in order to assess possible conflicts with other programs.

Section 4

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